

# Stability in Norwegian-Russian Trade - The Case of Institutional Incompatibility <sup>1</sup>

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### **Abstract**

What are the consequences of conducting trade with transitional Russia? This paper takes a look at possible consequences for trade when trade contracts cannot be fully enforced across international borders. It investigates the possibility of improved stability in trade by taking into account the incentive constraints of importers as well as exporters. The paper looks into stability determinants in Norwegian data on exports of fish to Russia in the years 1996-2004.

Focus is set on the need for Norwegian firms to strategically handle differences in institutional structure between Norway and Russia. The formal model shows that strategic thinking *could* influence trade stability and that this line of research should not be ignored. The empirical analysis finds support for the ideas laid out in preceding chapters.

## **Preface**

This paper is a master thesis written for the degree Masters in Economics at the University of Oslo. The paper investigates determinants of trade stability in Norwegian fisheries exports to Russia on a theoretical and empirical level. All calculations are executed using STATA version 9.0. Supervisor is Dr. Polit. (PhD) in Economics Arne Melchior at the Department of International Economics at the Norwegian Institute of Foreign Affairs.

The thesis is written in affiliation with the Center for Russian Studies at the Norwegian Institute of Foreign Affairs. I started working on the thesis as a student scholar at the Center for Russian Studies in the fall of 2006. The remainder of the thesis was completed while working full-time as an adviser at the Norwegian Barents Secretariat.

I would like to thank my wife Sigrun for moral support throughout the whole process, my supervisor Arne for invaluable assistance and my employers at the Secretariat for understanding.

Last, but not least, I would like to thank the Center for Russian Studies for taking me in as a student scholar. Affiliation to the Center has been of great inspiration and importance to me.

## Summary

What are the consequences of conducting trade with transitional Russia? This paper takes a look at possible consequences for trade when trade contracts cannot be fully enforced across international borders. It investigates the possibility of improved stability in trade by taking into account the incentive constraints of importers as well as exporters. The paper looks into stability determinants in Norwegian data on exports of fish to Russia in the years 1996-2004.

The goal of this paper is to investigate the consequences for bilateral trade of the difference in institutional design between Russia and Norway. There is no doubt that the economic institutions of Norway and Russia are dissimilar in many ways. Some times one can discover that an institution typical of the one country lacks a counterpart in the other country - defined property rights to real estate is one example.

In international trade an individual or a firm from one country that wishes to do trade in another country must learn the "rules of the game" in the country he wishes to do business. For the case of Norway and Russia, a Norwegian firm will have to learn to use such institutions as the Russian judicial system to enforce contracts. In some circumstances the Norwegian firm will discover that the Russian counterpart of a Norwegian economic institution such as property rights enforcement is not taken care of by the same authority as in Norway. Such a learning process is bound to take time. Until two countries have an extensive history of bilateral trade one cannot expect firms from one country to benefit from the institutions of the foreign country to the same degree as firms who are from this foreign country and to whom these institutions are familiar. When one or both sides in international trade experience higher transaction costs than they would conducting domestic trade because their market institutions differ from the institutions of their partner - I choose to speak of *institutional incompatibility*.

The concept of institutional incompatibility is interesting in connection with Norwegian-Russian trade. Institutional barriers to entry are high on the agenda of firms with interests in Russia, but there has been done little research in this field. For example 66,2 % of the respondents in the Norwegian Confederation of Enterprise's survey found activity related to the Russian market "hard, but not impossible". Furthermore the most significant barriers to working in Russia after government bureaucracy were corruption, language and communication and Russian business culture. The barriers experienced by Norwegian firms are of grave significance, since they effectively block participating in the wide range of contract enforcement measures employed by Russian firms.

To illustrate the possibility of strategic action on behalf of Norwegian ex-

porters I use chapter 2 to set up a simple model of Norwegian export flows to Russia. The main contribution of this model is to point out a new dimension of the fact that there are two ends to the deal also in international trade. In the model, trade stability is effected by firms' decision on whether to stick with their current partner or to engage in search activity. This decision depends on a cost-benefit analysis of the two alternatives. The results show that under the assumption of incomplete contract enforcement stability in trade relations can be explained among other things as a function of a firm's export price relative to the mean export price of the given product. We also find that the existence of sunk entry costs into the export market reduces stability. This result is in clear opposition to prevailing trade theory of sunk costs. Despite it's ambition the model remains crude and subject to future improvements.

In chapter 3 I investigate whether or not the predictions made by the theoretical model have empirical support by running a series of regressions on a micro level data set of Norwegian seafood exports to Russia. The implied price-stability relationship is found consistent with the data and the coefficients of relative price and squared relative price remain significant throughout a series of regressions.

There is some evidence that reduced search costs increases stability. However the distinction between out of market search costs and in market search costs is not drawn in the empirical treatment and the positive effect of a firm's experience in the Russian market may be a result of learning the rules of the game and utilization of strategic pricing rather than reduction in out of market search costs through learning. Furthermore improved stability is closely associated with time. As the years pass trades seem to become increasingly stable. On these grounds it is tempting to draw the conclusion that as firms come to know the market and the rules of the game, they increasingly price in a binding way - increasing stability.

Alternatively we might be witness to a tâtonnement process in a maturing market where exporters offering disequilibrium prices fall out of the market and reenter offering prices closer to equilibrium. Elaborating such an approach could explain both the price convergence and increasing stability observed in the data.

This paper focuses on the need for Norwegian firms to strategically handle differences in institutional structure between Norway and Russia. The formal model shows that strategic thinking *could* influence trade stability and that this line of research should not be ignored. The empirical analysis finds support for the ideas laid out in preceding chapters.

# Contents

<b>1</b>	<b>Introduction</b>	<b>2</b>
<b>2</b>	<b>A Search Model</b>	<b>10</b>
2.1	Some Intuition . . . . .	10
2.2	Formal Modeling . . . . .	15
2.3	To Stay or To Search? . . . . .	18
2.4	Renege or Abide? . . . . .	23
2.5	Predictions . . . . .	23
2.6	Issues . . . . .	26
<b>3</b>	<b>Empirics</b>	<b>28</b>
3.1	Data and Methodology . . . . .	28
3.2	The Empirical Model . . . . .	29
3.3	Regressions . . . . .	32
3.4	Conclusions . . . . .	42
3.5	Issues . . . . .	43
<b>4</b>	<b>Results</b>	<b>47</b>
<b>A</b>	<b>Mathematical Appendix</b>	<b>52</b>
A.1	Solving for Out of Market Profit in the <i>Search-Search</i> Equilibrium for Player $i$ . . . . .	52
A.2	Nash Equilibrium Conditions for <i>Search-Search</i> . . . . .	53
A.3	Comparing Expressions 2.2 and 2.3 . . . . .	53
A.4	Renege or Abide? . . . . .	54
A.5	Payoff Increasing in Stability? . . . . .	54
<b>B</b>	<b>Appendix</b>	<b>55</b>

# Chapter 1

## Introduction

The goal of this paper is to investigate the consequences for bilateral trade of the difference in institutional design between Russia and Norway. There is no doubt that the economic institutions of Norway and Russia are dissimilar in many ways. Some times one can discover that an institution typical of the one country lacks a counterpart in the other country - defined property rights to real estate is one example.<sup>1</sup> Before continuing I lend on Douglas North for a definition of economic institutions.

”Institutions are the rules of the game in a society, or more formally,  
are the humanly devised constraints that shape human interaction”  
North (1990)

North (1990) focuses on the need for institutions to ensure low cost enforcement of contracts. Institutions’ ability to provide such low cost enforcement is what makes them efficient. Without efficient institutions many transactions will not take place or will lead to distribution of property rights different from what would be the case with efficient institutions. The absence of efficient institutions renders the *ex-ante* distribution of property rights consequential to the *ex-post* results of trade.

In international trade an individual or a firm from one country that wishes to do trade in another country must learn the ”rules of the game” in the country he wishes to do business. For the case of Norway and Russia, a Norwegian firm will have to learn to use such institutions as the Russian judicial system to enforce contracts. In some circumstances the Norwegian firm will discover that the Russian counterpart of a Norwegian economic institution such as property rights enforcement is not taken care of by the same authority as in Norway. Such a learning process is bound to take time. Until two countries have an extensive

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<sup>1</sup>It has only recently become possible to buy, own and sell real estate.

history of bilateral trade one cannot expect firms from one country to benefit from the institutions of the foreign country to the same degree as firms who are from this foreign country and to whom these institutions are familiar.

In short - institutions that are efficient with respect to internal domestic trade might be inefficient with respect to international trade. When domestically efficient institutions turn inefficient because foreign firms lack the know-how to utilize them one can speak of institutional incompatibility as the cause.

Institutional incompatibility is the term to be used when describing a situation where users from society  $A$  experience different transaction costs in society  $B$  than domestic users of economic institutions in society  $B$  because these institutions are somehow different from the economic institutions in society  $A$  and users from society  $A$  have yet to learn how to use the economic institutions in society  $B$ .

Belloc (2006) suggests institutional diversity as one of the main "hidden" trade barriers today. According to her, institutional diversity necessitates the increased gathering of information and investment in trade relations. Such activity involves sunk costs which might help explain why seemingly similar countries trade relatively more with each other - contrary to the theory of comparative advantage. In this paper I investigate the possible consequences of one result of institutional incompatibility - imperfect contract enforcement. International trade is in many cases governed by incomplete contracts characterized by imperfect contract enforcement (Belloc 2006) . Under such circumstances strategic action may be taken by trading partners to avoid moral hazard and ex-post opportunism, which leads me to formulate the following working hypothesis for this paper:

*Due to incomplete contracts and imperfect contract enforcement price can be used strategically to influence trade stability. The extraordinary entry-exit behavior of Norwegian seafood exporters into the Russian market as observed by Melchior (2006) , can in part be explained the choice of price by exporting Norwegian firms.*

To illustrate the possibility of strategic action I use chapter 2 to set up a simple model of Norwegian export flows to Russia. In chapter 3 I investigate whether or not the predictions made by the theoretical model have empirical support by running a series of regressions on a micro level data set of Norwegian seafood exports to Russia. The results show that under the assumption of incomplete contract enforcement stability in trade relations can be explained among other things as a function of a firm's export price relative to the mean



export price of the given product. We also find that the existence of sunk entry costs into the export market reduces stability. This result is in clear opposition to prevailing trade theory of sunk costs. In works such as Dixit (1989) sunk costs are claimed to increase stability by a hysteresis argument.

Entering a foreign market involves sunk costs. The investment is made when market conditions and expected trade volume is large enough to cover the investment costs. If conditions deteriorate after entry the firm might still stay in the foreign market because the investment was sunk and no longer part of the future profitability calculation. Such an approach ignores a very important aspect of trade and international investment - the foreign partner. There are always two parties to a transaction. If the firm exports a product there is a foreign buyer of this product. If the firm invests in a plant there is a seller of the plant itself or the real estate on which the plant is to be built. In any case property rights are being shifted. Contracts and institutions are at play. I am not the first to emphasize the role of contracts, the concept of enforceability and strategic action of the trading partners in international trade. Grow and Swinnen (2001) discuss how firms have vertically integrated up- and downstream of each other to avoid holdups through commitment and control. Marin and Schnitzer (2002) discuss extensively the effects on trade when contracts cannot be enforced - both in transition economies and in international trade. They suggest buy-back contracts, hostage holding and barter as some of the remedies to keep trade going. In international trade they focus on trade between state controlled socialist economies and partners in the west. Today the state in post-socialist countries has only a negligible role in international goods trade. Trade is conducted between much smaller players. Thus the trade schemes described by Marin and Schnitzer are not feasible for players such as Norwegian fish exporters. While trade upholding arrangements such as buy-back contracts are no longer possible, market economy institutions such as contract enforcement have still to become fully developed. Herein lie the main contributions of this paper. Firstly I show how trade is subject to the strategic decisions of the players and secondly I show that when the strategic considerations of both parties to the transaction are taken into consideration sunk costs have a quite different effect on stability in international trade. Anderson and Young (2006) advocate a similar approach where they discuss repudiation and the distribution of traders between spot and contract (futures) markets. My approach departs from theirs. When considering a situation where the number of buyers exceeds the number of sellers Anderson and Young contend that the contracted price is determined by buyers switching between the spot and contract markets until the price they expect to pay in both is same. My point of departure is that sellers can strategically choose their contract price and thus keep buyers in the contract market by meeting the

buyers' incentive constraints.

For the remainder of this chapter I will shortly discuss the role of institutions and try to describe the nature of incompatibility between Norwegian and Russian economic institutional design.

The Coase Theorem states that in the absence of transaction costs the efficient outcome will prevail irrespective of initial property rights allocations because interested parties will bargain privately till all mutual gains from trade have been exhausted (Coase 1960). Coase's main point was that the efficient outcome does not always prevail because the neoclassical assumption of zero transaction costs does not hold. Since then the Coase Theorem has been proven not to hold, also because of asymmetric information. The comic strip Dilbert proves this quite elegantly, see appendix B. Since transaction costs are generally existent *ex-ante* property rights allocations have a big impact on economic outcomes. Yeager (1999) calls upon *institutions* to "define and enforce property rights". Institutions are needed to verify if the terms of a sales contract have been fulfilled. Amount, quality, time of delivery and amount of payment are all topics for potential dispute. If institutions are not in place, many trades will not take place and hinder the efficient outcome.

Institutions need not be buildings with bureaucrats and a system of enforcement such as the police. Trade takes place even in societies without written laws, a judicial system and public police. Trade also took place in western society before the current system of governance was developed. Relevant for this paper are the institutions of contract enforcement. The way a society organizes its contract enforcement can be divided into two major categories - rule- and relation-based governance. Under rule-based governance contracts are enforced by a third party - the symbiosis of legislative, judicial and executive powers. In economic modeling this third party is generally referred to as the courts. Under relation-based governance contracts are self-enforcing. The loss from breaching a contract without third party interference is sufficient to avoid such behavior. Formal institutions are replaced by mechanisms such as reputation, contingent contracting, collective punishment and more. Kandori (1992) discusses society's ability to convey an agent's history when observability is not perfect and the possibility for collective punishment or *community enforcement*. Dixit (2003) looks at how the mechanism of collective punishment is influenced by community size.

Every society is characterized by both types of governance. In many cases taking a dispute to court is considered a last resort. Also in our society the role of reputation and other means of relational governance should not be underestimated. There is though a key characteristic that can be used to differentiate between rule- and relation-based systems of governance. The success of out of

court dispute regulation can be attributed to the credible threat of reaching a binding verdict in court. Economic agents in conflict might prefer going to court for a verdict to accepting the full economic loss from contract breach, but might also prefer reaching the same verdict themselves without the court because they don't have to carry the, in many cases substantial, costs of a law suit. Thus the formal institutions play an important, though not necessarily active role in a rule-based system of contract enforcement. If a verdict in court is too costly to reach, or it is not binding, and agents prefer the full loss of contract breach to a law suit then formal institutions play no role in contract enforcement. In such a situation relation-based governance prevails.

The demarkation line has been drawn up as a background for Dixit's concept of a "clash of expectations" (Dixit, 2006). Different systems of governance naturally imply different patterns of optimal strategic behavior. The prerequisite for agents being rational is that they choose strategies that are optimal, i.e. maximize their expected payoff. The question of which strategies are optimal is more than often contingent on the strategies chosen by the agent's "opponents". Thus a major part of choosing one's own optimal strategy is predicting other players' optimal behavior. If a player belonging to one system of governance and attempts to predict the optimal responses of a player belonging to a different system of governance, then unawareness of differing system origin could have intriguing consequences. Both players, expecting that the opposing player(s) belong to the same system of governance, predict a set of best response strategies. When strategies are played the opposing player(s)' responses could significantly differ from the expected. The opposing players might be playing strategies that initially were assigned zero probability. Such unexpected behavior should lead a real life player to question if he has fully understood the rules of the game. If his beliefs about the rules of the game are not updated, the rationality of opposing players is consequentially put to question. The situation described here can be described as a "clash of expectations", the players differing expectations regarding system of governance do not yield correct predictions. What we have seen described here is a direct result of the presence of institutional incompatibility. If the players had learned the rules of the game in the opposing player(s)' society, they would be able produce accurate predictions. This issue might at first glance seem a trivial one, but Li (2003) shows that the transition from one system of governance to another in liberalizing Asian economies lead to an outburst of speculation and attributes the Asian Crisis to the incompatibility of relation- and rule-based systems of government. Li (2003) argues that when trading partners from rule- and relation based systems of contract enforcement meet, and the rule-accustomed (western) partner underestimates the role of relational enforcement in the second country, then

the "clash of expectations" may lead to increased risk for the western partner and a "rush in and rush out" investment behavior. Thus the more similar are two national institutional environments, the higher will the trade be between these two countries. This is also the conclusion of Anderson and Marcouiller (1999, 2002). They find that insecure institutions constrain trade as much as tariffs do, and suggest good institutional support as simple explanation for the disproportionate trade between rich, capital abundant countries. Their argument's strength is that it does not conclude that poor labor abundant countries should be trading predominantly among themselves.

There are several different views on contract enforcement in post-socialist Russia. Research has been conducted over time so the various conclusions might be a result of development. Kossykh and Sarychev (2000) choose the intriguing approach of studying contract enforcement out of steady state. If both systems of governance evolve together with the economy, then updating one's beliefs is further complicated for western agents active in the Russian market.

Hendley, Murrell and Ryterman (2000) draw up a picture of Russian firms' transactional strategies based on survey data from 1997 indicating that that these do not differ much from the strategies of western companies. They find that Russian firms do not, contrary to common beliefs, rely heavily on private protection organizations - the mafia. Russian firms prefer a combination of informal and formal business meetings to resolve disputes and employ the judicial system if the former methods do not deliver. Prepayment is commonplace, but the fraction of total payment is reduced if the buyer offers some property for hostage. Frye (2002) on the other hand using survey data from post-crisis 1998 grants private protection organizations a more significant role. His results are ambiguous. On the one hand Frye concludes that the private protection organizations are unwanted by small businesses, on the other hand these organizations provided not only protection from rival private protection organizations, but also credit. A third of the respondents who had been in contact with a private protection organization said the organization had helped enforce contracts. Kossykh and Sarychev (2000) claim that Johnson, McMillan and Woodruff (1999) provide evidence that "it is indeed the insecure contract environment that hinders investment, not the lack of outside finance".

Centralized planning in the Soviet Union and the failure to take into account transportation costs allowed an economic geography where inputs were fetched from one production facility in one corner of the Union and transported to another production facility in another corner of the Union. This system allowed a certain input to be supplied by one or a few locations, in many cases far away. In result when the Union collapsed a few large upstream production facilities were left with a multitude of downstream clients all over the former Union. After the

annihilation of the central planning ministry, compliance with contracts was no longer enforced by a third party. The fact that the different production facilities were now located in different independent countries complicated enforcement by the national courts. The distance from upstream to downstream companies, if one is to believe the conclusions of Dixit (2003), complicated relational governance of contracts. Firms were forced to find different ways of securing inputs for their production. Johnson and Kroll (1991) describe the beginning of restructuring and vertical integration on a more narrow geographical basis. The issue of ensuring compliance to contract led to a rise of barter among Russian enterprises. Although barter was common in the Soviet economy Seabright (2000) finds an explosion of the practice throughout the 1990s after a small decline during the early transition years. Marin and Schnitzer (2002) suggest that barter was used to reduce transaction costs in connection with contract enforcement. A seller would be more willing to accept a barter payment than a future cash payment because it is much harder for the buyer to later claim that he does not have the merchandise than to claim he has no cash. In case of forced contract enforcement a tangible good is more easy to seize than money because of underdeveloped financial institutions. Guriev (2001) provides a formal model of firms' choice of payment based on the transaction costs associated with money, *veksels* and tangible goods. The underlying notion is insufficient property rights enforcement.

The concept of institutional incompatibility is interesting in connection with Norwegian-Russian trade. Institutional barriers to entry are high on the agenda of firms with interests in Russia, but there has been done little research in this field. For example 66,2 % of the respondents in the Norwegian Confederation of Enterprise's survey (NHO 2003) found activity related to the Russian market "hard, but not impossible". Furthermore the most significant barriers to working in Russia after government bureaucracy were corruption, language and communication and Russian business culture. Hendley, Murrell and Ryterman (2000) describe a variety of relational contract enforcement measures used by Russian firms. The barriers experienced by Norwegian firms are of grave significance, since they effectively block participating in the wide range of contract enforcement measures employed by Russian firms. Norwegian firms are forced to bring their disputes to court; a procedure that is lengthy and far from the preferred even when in domestic disputes.

Understanding the effects, and process, of institutional incompatibility might help us avoid some of the risk from moral hazard as described by Li (2003), and perhaps reduce sunk costs that arise from being forced to participate in relational contracting in a foreign environment. Such a task is naturally beyond the scope of this paper, but I believe that an institutions approach to trade and

investment in Russia deserves increased attention. I hope at least to contribute to increased attention by means of this paper.

## Chapter 2

# A Search Model

In this chapter I will try to give an example of how incomplete contract enforcement can affect trade between Norway and Russia. The general goal is to shed light on the effect on trade of the disparity between institutions of economic governance. Because players cannot *ex ante* credibly commit to a contractual arrangement, the degree to which a trade relation continues over time is subject to the strategic considerations of the players. As we shall see when the actions of both parties' of a trade relation are endogenous, the presence of sunk search costs might serve to destabilize the trade relation. We shall also see how under certain circumstances, price can be used strategically to make the contract self-enforcing. The following model is by no means intended to be general, nor does it claim to accurately capture the dynamics of Norwegian-Russian trade. It is my hope that it serves as a probable explanation of instability in exports to Russia, thus justifying further research.

In the model, trade stability is effected by firms' decision on whether to stick with their current partner or to engage in search activity. This decision depends on a cost-benefit analysis of the two alternatives.

### 2.1 Some Intuition

Any Norwegian firm that wishes to export to Russian market, must match with a Russian importer who is willing to buy the good in question. The model's predictions are to be tested against data on seafood exports. Therefore the good in question will from now on be referred to as fish.

den Butter and Mosch (2003) distinguish three stages in a trade transaction - contact, contract and control. Each stage has its associated transaction costs. In the contact stage traders have to invest in search efforts to find potential buyers / suppliers. In a fish export context such costs might arise from adver-

tising, traveling and attending fish expos, or services from an export promotion organization such as the Norwegian Seafood Export Council (NSEC). Costs in the contract stage are related to the writing of the contract, that is reaching an agreement on the terms of the trade transaction. Indeed this may be no easy task. First negotiating in two languages through an interpreter, costs money and time. Misunderstandings can arise due to different paradigms. Something that is assumed to be unproblematic for a Norwegian trader using Norway as a reference point, may in fact be not at all a trivial issue for the Russian trader. For example labeling of goods, and goods declaration are serious issues. Consequences might be dire if papers are not filled out correctly. Undocumented cargo, is not simply not allowed to enter the country until correct paperwork is in place, but might be confiscated and the means of transport arrested until fines are paid <sup>1</sup>. Such delays are costly and care must be taken in the contracting process to avoid them. Firms in the model must therefore incur a search cost in order to establish a trade relation and enter the market. These search costs are assumed to be sunk. This is an assumption in line with the theory of sunk costs in international trade.<sup>2</sup>

For firms that are already in the export action, search costs are likely to be lower. Having already contracted once, important lessons have been learned and one can apply the same trade scheme to a different partner. Furthermore, firms that export to one importer might get to be known among other importers, since these most likely monitor each others actions and trade relations. Documentation of such effects is not directly available, but Medin (2006) finds that when seafood firms already export a good to a certain country, chances increase that they next period not only will continue exporting this good to this country, but chances increase that they will enter this market with a new product. Firms learn from being in the market, reducing the cost of entering with new products. In the model, this insight finds a slightly different application. Firms that are already in the market have lower search costs than firms that are out of the market. Firms that have been in the market, do not of course necessarily lose the experience and learning they have been through. But it is assumed that crucial in market benefit is lost if one falls out of the export-import action. Thus firms that are out of the export-import action must incur higher search costs than firms that are in. A justification for such an assumption can be found in Roberts and Tybout (2006). They find that after a two-year absence the reentry costs of Columbian chemicals exporters are not significantly different from those faced by a new exporter. The goal of this study is not to investigate why

<sup>1</sup>Source: Eimskip, liberal quotation of Trond Lorentzen - Company Representative at an NMC II logistics workshop in St. Petersburg Nov. 2006.

<sup>2</sup>Sunk costs in international trade are treated in among others Dixit (1989) and Roberts and Tybout (1997).



firms enter initially, but what effects stability once they have entered. Since initial entry cost can be assumed to be generally sunk, they do not effect the strategic decision process that is subject to analysis in the model. These costs are therefore ignored. In the beginning of the game firms find themselves in the export-import action without any further explanation as to how they got there. In interest of expositional simplicity out of market search costs are modeled as a linear transformation of in market search costs.

In the model it is assumed that Norwegian firms set the price at which they wish to trade and then match-up with a Russian partner. I assume for simplicity zero production costs. Pairing is assumed to be random. Since there is a fair amount of price variation in the data, the assumption of an exogenous market price does not hold and I choose to view price as a strategic variable available to Norwegian firms. The Norwegian firms can be viewed as price setters. They might for example operate with a reservation price strategy. As long as the price offered by a Russian importer is over the reservation price, they accept. Such a reservation price might be a function of among others the firms cost structure, general price developments or some targeted mark-up on marginal cost. In any case, where firms choose to place themselves along the price distribution is in the model considered a strategic choice. If firms are pricing equal to marginal costs, then this strategic choice has a corner solution. In the modeling I abstract from firms' cost structure.

Once every Norwegian firm has set its price, paired-up with a Russian partner and the transaction as been carried out the price distribution becomes know. The NSEC for example publishes monthly price statistics for all major markets. Firms then have the possibility to update their believes concerning feasible prices. Norwegian firms might see an opportunity to increase the price at which they sell, by contracting with a new partner. The converse applies to Russian firms. Of course contracting with a new partner is associated with a cost as explained above.

The main idea in the model is that Norwegian firms sign long run contracts with their Russian partners. They agree to deliver a certain amount at a certain price for some specified amount of periods. But these contracts are subject to incomplete legal contract enforcement. A natural consequence is that only payment or delivery default in the next period can be legally considered a contract breach. Two periods ahead, both the Norwegian and Russian partners are free to scrap the contract in favor of a new partner. Long run contracts in trade with Russia are subject to *ex-post* opportunism. Firms can of course choose to stick with their current partner, but this decision is taken after weighing costs up against expected gain. The details of this procedure are exposed in the formal modeling below.

Decisions on what price to set, whether to stay with one's current partner are part of a sequential process. The model therefore takes on the shape of a dynamic game. Often the sustainability of a cooperative equilibrium is shown in the framework of an infinitely or indefinitely repeated game. Because I introduce a multitude of explanatory variables an infinitely repeated game would lead to a quite tedious algebraic solution of the game. By assuming that no Russian firm wants to remain out of the market for ever and that this is the fate for firms that repeatedly renege, the cooperative equilibrium can be sustained even in the setting of a finite game. Thus, as it does not change the final results, I choose to stick to a finite game in the formal modeling.

Firms enter the market having first paired in period  $t$ . Simultaneously Russian firms have the opportunity to renege the contract by defaulting on their payment<sup>3</sup>. Russian firms can not in practice be held accountable for such behavior. Uncertainty as to who on the Russian side is in fact responsible, might make a lawsuit unreasonably lengthy and expensive<sup>4</sup>. Firms might restructure and reappear under new guise, making them hard for Norwegian exporters to recognize and even harder to prosecute. In the model, if a Russian firm reneges it "lays low" and leaves the market for one period. Reentering is associated with a sunk cost even greater than the usual out of market search cost. It seems plausible that defaulting firms have to make some additional effort to cover their tracks (i.e. hide their history). Defaulting firms might have to go through a costly termination and re-registration procedure. Changing their name might also cause confusion damaging the firms' relation with other (e.g. downstream) partners. For simplicity it is assumed that firms with repeated defaults are subject to costless identification by Norwegian firms. The default alternative is therefore considered only once, and does not enter the profit function of defaulting firms again. It is also assumed for simplicity that if firms find it non-optimal to default in the current period, they will also ignore this option in assessing future expected profit. The main focus of this paper is the stability issues in the static sub-game of the cooperative equilibrium. The renegation aspect of the game is added to give grounds for an extended discussion.

Given that the Russian firm does not cheat, cooperative payoffs are realized in period  $t + 1$  and both firms can choose to invest in search efforts this period. Teaming up with a new partner will effect payoff in period  $t + 2$ . The goal of

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<sup>3</sup>Norwegian firms could also in theory have such an option, but it seems intuitively less likely and does not alter the conditions for further discussion. Such a notion concurs with Dixits (2006) remark that it is easier for agents from a relation-based system of governance to utilize the institutions of a rule-based system of governance than vice versa. Hence this aspect is dropped.

<sup>4</sup>Seafood import in Russia is to a large extend a gray business. I order for an importer to survive, he is dependent on a large apparatus of double bookmaking and Swiss bank accounts, Svein Ruud Troika Seafoods.

the model is to show how under incomplete contract enforcement the amount of stability in trade relations can become effected by strategic choice. Stability in trade, i.e. abidance of the long term contract, is achieved when both partners find it preferable to stay with each other and not search. The *stay-search* decisions take the form of a static game, the payoffs of which realize in period  $t + 2$ . This static sub-game will serve as the foundation for the empirical stability analysis. The expected payoff in this sub-game naturally enters into the payoff calculation in period  $t$  regarding whether or not to renege the contract. In order to isolate potential determinants of trade stability I build a number of export price intervals compatible with the players' incentive constraints as to choosing between the strategies *Stay* and *Search*. In particular I deduce the interval for which *Stay* is the dominant strategy for each player. Under certain circumstances these intervals overlap, rendering *Stay* simultaneously dominant for both players.

Anderson and Young (2006) provide an intriguing model of incomplete contract enforcement in international trade. They consider a situation of excess demand, when the number of buyers exceeds the number of sellers. They provide an explanation to contract repudiation through shocks to the traders outside options and following increased bargaining power in the spot market. Shocks are unknown *ex-ante* and realized only after contracts have been signed. A buyer who after having contracted realizes his true outside option, i.e. the price of the good in his domestic market, might consider repudiating the contract. If this price is lower than the expected price in the spot market the trader experiences increased bargaining power in this market and might choose to repudiate in search of a better deal. They also provide an explanation to why in some countries institutions of contract enforcement are underdeveloped despite the fact that the same authors in an earlier paper show that all traders under certain circumstances will be better off with impartial third-party enforcement (Anderson and Young, 2000). In the context of Norwegian fisheries exports to Russia there are a couple of Anderson and Young's assumptions that can be questioned. One issue is the realism of the buyers outside option. Norway has been the market leader in Russia when it comes to fisheries exports and it is questionable whether fisheries products can be obtained from some other source at a price that is low enough to support the kind of behavior described by Anderson and Young. If a more preferable deal should enter the picture after the contracting stage, it should be coming from other Norwegian exporters. In the model in chapter 2 the outside option of the Russian importer therefore takes the form of a possibility to contract a more preferable price once the true distribution of contracted prices is unveiled.

Secondly and more importantly Norwegian exporters should be able to fore-

see the potential repudiation and contract at a price that prohibits *ex-post* opportunism. That is suggest a price low enough to remove the benefit of recontracting *ex-post*. It is implicitly assumed that all firms match in the first round regardless of price suggested by the Norwegian firm. Complete matching is ensured by the Russian importers' default alternative. If the Norwegian's price is too steep, the importer can always accept and not pay. The nonstrategic nature of Anderson and Young's contract price can be supported by the assumption of risk neutrality. If the expected price is the same in both markets then risk neutral sellers will not be willing to reduce their contract price because they are indifferent to repudiation as long as it is not associated with some additional cost. Risk neutrality seems a rather strict assumption in the case of Norwegian fisheries considering the amount of investments and vulnerability of especially fish farmers to downward price trends. It seems plausible that exporters strictly prefer a guaranteed contract to stochastic price realization. Although risk aversion does not enter the following model explicitly, the effect is ensured by the fact that expected profit is increasing in stability so traders will prefer stability as under explicit risk aversion.

Despite it's ambition the model below remains crude and subject to future improvements. Issues such as repeatedness, price convergence and the effects of in market price on export price will be discussed briefly in section 2.6.

## 2.2 Formal Modeling

Let us begin by assuming a population of Norwegian and Russian firms who wish to engage in cross-border trade. The model focuses on the bilateral trade relation between one Norwegian and one Russian firm who constitute the players of the game. Throughout the text subscripts  $n$  and  $m$  will refer to the Norwegian and Russian player respectively. In the beginning of the game, time  $= t$ , each Norwegian firm chooses its export price  $X^E$ , the two countries' firms are randomly paired and the firms enter the foreign trade market. In the following we investigate pairwise relations and explicitly model the first three periods of a game with indefinite horizon.

When two firms pair they sign a long term contract where the Norwegian firm agrees to deliver some amount of produce at the price  $X^E$  at the beginning of each period for two periods. This amount is for simplicity normalized to one. Once the firms have entered, all firms learn the distribution of all export prices. We assume for simplicity that this distribution is uniform. Thus, for any  $X^E$  there is scope for improving one's deal by  $\Delta X^E$  for the Norwegian firm and  $\Delta X^{E'}$  for the Russian firm.

Thus

$$Prob(X < X^E) = U(X) = \frac{X^E - \underline{X}}{\bar{X} - \underline{X}} \quad \forall X \in (\underline{X}, \bar{X}) \quad (2.1)$$

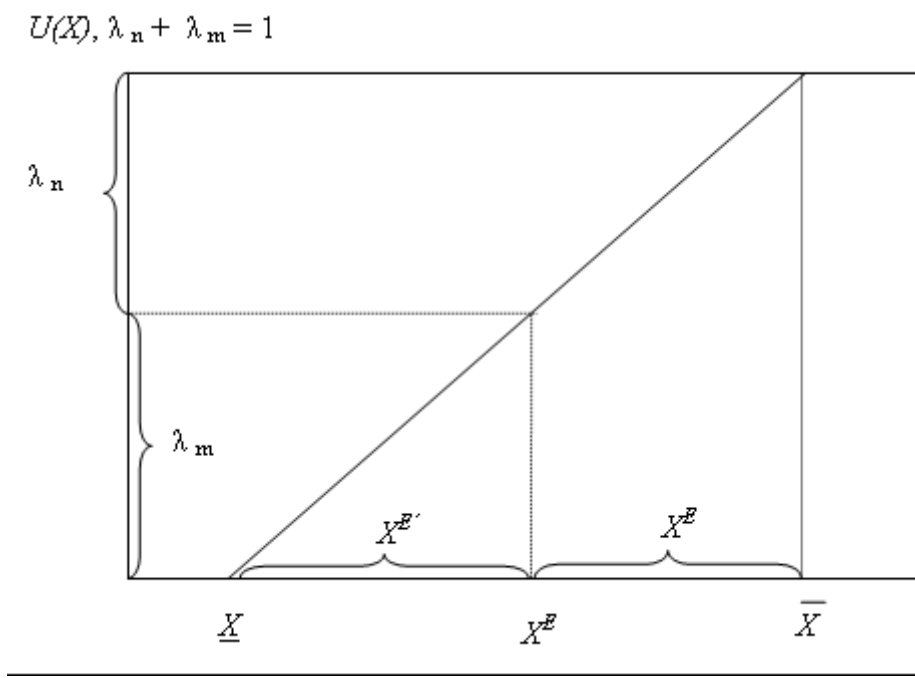


Figure 2.1: The Distribution of  $X^E$  and the Interpretation of  $\Delta X^E$

From Figure 2.1 we see the possibilities the firms face for any  $X^E$ . The assigned probabilities  $\lambda_n$  and  $\lambda_m$  can be interpreted as the Norwegian and Russian firm's probability respectively of finding a partner willing to trade at a more preferable export price. These always sum to one,  $\lambda_n + \lambda_m = 1$ . The distribution becomes known first after all firms have matched, but before transactions have been fully completed. The scope for improving the export price is taken into account by Russian firms before they make the decision to abide or renege.

Having received the first shipment as agreed, the Russian firm realizes this produce in the Russian market at an exogenous in market price  $X^{IM}$ . The Russian firm is then faced by the choice of either to abide by the contract and pay  $X^E$  or to renege the contract and pay nothing. If so the defaulting Russian firm exits the market and is forced to pay a greater out of market search cost, than firms that end up out of the market having chosen the *abide* strategy. The Russian firm then earns a renege profit  $X^{IM}$ , the Norwegian firms earns nothing but must pay the out of market search cost  $\gamma_n C_n$  in order to reenter in  $t + 2$ .

If the Russian firm abides by the contract, the equilibrium is a cooperative

one. Both firms acquire a  $t + 1$  payoff  $X_n^{AB} = X^E$  and  $X_m^{AB} = X^{IM} - X^E$  and face a new strategic situation. They must decide whether to rely on the long term contract and stay with their existing partner or to search for a new one which involves a cost. Depending on both players' actions equilibrium specific profits are realized at  $t + 2$ . Since the two players' choices regarding *Stay-Search* are taken simultaneously resulting payoffs are determined in a static sub-game. Figure 2.2 describes the chain of events and profit realization.

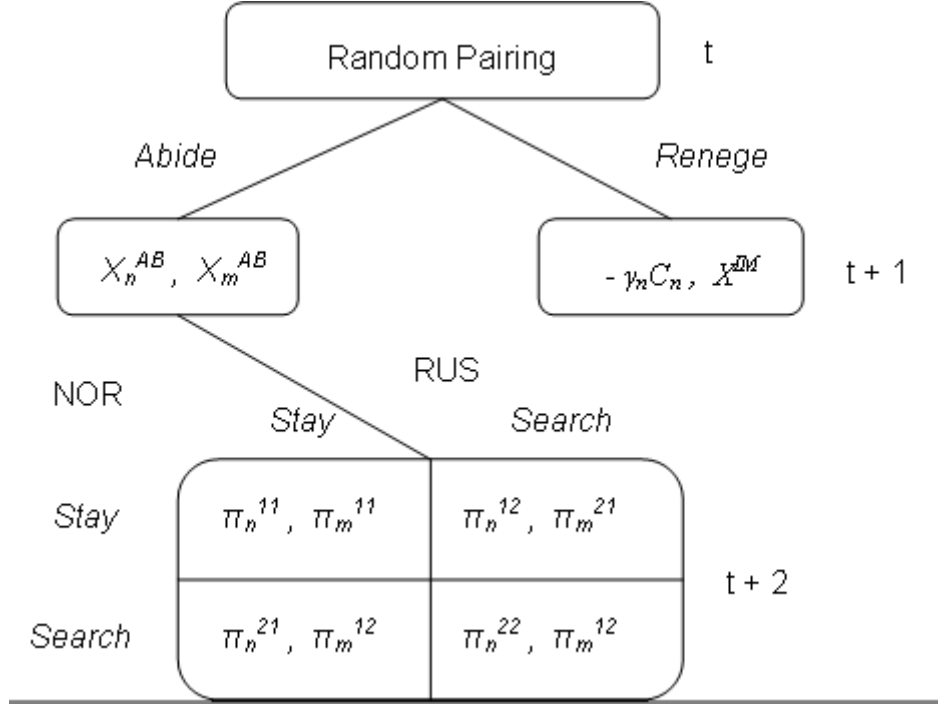


Figure 2.2: Game Overview

For simplicity I assume that parameter values do not change for the entire duration of the game. As the game unfolds strategies chosen initially regarding the static *Stay-Search* game remain optimal every period. The assumption also applies to the *Abide-Renegade* sub-game taking place prior to the *Stay-Search* decision. This stability assumption is made to ensure easy comparison of immediate and future profits.

We analyze the game by backward induction starting with the static *Stay-Search* game.

### 2.3 To Stay or To Search?

In the static *Stay-Search* game each player faces four possible expected payoffs. To avoid repeated specification the equilibrium specific profits specified below are universalized. Subscripts  $i$  and  $j$  refer to the players.  $i$  is the player under scrutiny while  $j$  is the opposing player. The superscripts 1 and 2 refer to actions *Stay* and *Search* respectively. The first number indicates the action chosen by player  $i$  and the second - the action chosen by player  $j$ . Thus  $\pi_i^{21}$  can refer to the Norwegian player  $n$ 's payoff if he searches and the Russian player stays, or the Russian player  $m$ 's payoff if she searches and the Norwegian player stays. Player  $i$ 's equilibrium specific payoff for any strategy pair is simply  $\pi_i$ , and can be any of the four below depending on the equilibrium of the static game.

$$\begin{aligned}\pi_i^{11} &= X_i^{AB} \\ \pi_i^{22} &= \lambda_i (X_i^{AB} + \Delta X_i^{AB}) + (1 - \lambda_i) (\lambda_j \pi_i^{OM} + (1 - \lambda_j) X_i^{AB}) - \frac{C_i}{\delta_i} \\ \pi_i^{12} &= \lambda_j \pi_i^{OM} + (1 - \lambda_j) X_i^{AB} \\ \pi_i^{21} &= \lambda_i (X_i^{AB} + \Delta X_i^{AB}) + (1 - \lambda_i) X_i^{AB} - \frac{C_i}{\delta_i}\end{aligned}$$

where out of market profit

$$\pi_i^{OM} = \delta_i \left( \pi_i^{IM} - \frac{\gamma_i C_i}{\delta_i} \right)$$

and in market profit

$$\pi_i^{IM} = X_i^{AB} + \delta_i \pi_i$$

If both players play *Stay* they get the payoff postulated in the contract. If, on the other hand, both play *Search* player  $i$  finds a better partner with probability  $\lambda_i$ . If he does not succeed there is a certain probability ( $\lambda_j$ ) that his current partner has found a better partner whereupon he is forced to exit the market and earns  $\pi_i^{OM}$ . If player  $j$  also does not succeed the two players continue their trade relation also in period  $t + 2$ .

$C_i$  is a sunk cost incurred by searching. It is discounted backwards by a discount factor  $\delta_i$  because this cost is incurred in the period prior to profit realization, that is in period  $t + 1$ . In the expression for out of market profit  $C_i$  is augmented by  $\gamma_i > 1$ .  $\gamma_i$  is thus the ratio of sunk search costs for firms out of the market relative to search costs for firms in the market and represents the difference in establishment costs for firms in and out of the market as argued above <sup>5</sup>.

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<sup>5</sup>It might seem overly simplistic, but I feel that modeling the different establishment

It is a goal of this paper to point out possible determinants of stable relations. In the context developed above this implies the determinants of a *Stay-Stay* equilibrium in  $t + 2$ . In order to identify possible conditions for stable trade relations it is most beneficial to concentrate on the two symmetric equilibria. For any strategy pair *Search-Search* or *Stay-Stay* to be a Nash Equilibrium neither firm can regret its decision. In order to determine the conditions for either equilibrium I proceed by comparing pay-offs from playing symmetric strategies to pay-offs from playing the alternate strategy. I begin by deriving the Norwegian conditions for both equilibria. But first I state out of market profit in the *Search-Search* equilibrium. It is this out of market profit that will figure in the comparisons to follow.

*Solving for  $\pi_i^{OM}$  in the Search-Search equilibrium*

$$\pi_i^{OM} = \frac{H}{K} X_i^{AB} + \frac{\delta_i^2 \lambda_i}{K} \Delta X_i^{AB} - \frac{\gamma_i + \delta_i}{K} C_i$$

where

$$H = \delta_i + \delta_i^2 - \delta_i^2(1 - \lambda_i)\lambda_j$$

and

$$K = 1 - \delta_i^2(1 - \lambda_i)\lambda_j$$

### 2.3.1 Norwegian Equilibrium Conditions

For the strategy pair *Search-Search* or *Stay-Stay* to be a Nash Equilibrium neither firm can regret its decision.

*Nash equilibrium conditions for Search-Search*

$$\begin{aligned} \pi_n^{22} \geq \pi_n^{12} &\Rightarrow \lambda_n (X^E + \Delta X^E) + (1 - \lambda_n) (\lambda_m \pi_n^{OM} + (1 - \lambda_m) X^E) - \frac{C_n}{\delta_n} \geq \lambda_m \pi_n^{OM} + (1 - \lambda_m) X^E \\ &\rightarrow \lambda_n \Delta X^E + \lambda_n \lambda_m (X^E - \pi_n^{OM}) \geq \frac{C_n}{\delta_i} \end{aligned}$$

inserting  $\pi_n^{OM}$

---

(search) costs as linear combinations of each other is sufficient to illustrate the point that these costs differ depending on firms' position with respect to the export action.



$$\begin{aligned}
&\Rightarrow \lambda_n \lambda_m (1 - \delta_n - \delta_n^2) X^E + \lambda_n (1 - \delta_n^2 \lambda_m) \Delta X^E \\
&\geq (1 - \lambda_m \delta_n (\delta_n + \gamma_n \lambda_n)) \frac{C_n}{\delta_n}
\end{aligned} \tag{2.2}$$

*Nash equilibrium conditions for Stay-Stay*

$$\begin{aligned}
\pi_n^{11} \geq \pi_n^{21} &\Rightarrow X^E \geq \lambda_n (X^E + \Delta X^E) + (1 - \lambda_n) X^E \\
&\Rightarrow C_n \geq \delta_n \lambda_n \Delta X^E
\end{aligned} \tag{2.3}$$

*Comparing expressions 2.2 and 2.3 allows us to investigate the possibility of two equilibria in the Stay-Search game*

$$\begin{aligned}
\frac{\lambda_n \lambda_m (1 - \delta_n - \delta_n^2) X^E + \lambda_n (1 - \delta_n^2) \Delta X^E}{(1 - \lambda_m \delta_n (\delta_n + \gamma_n \lambda_n))} &\geq \frac{C_n}{\delta_n} \geq \lambda_n \Delta X^E \\
&\Rightarrow \Delta X^E \geq \frac{\delta_n^2 + \delta_n - 1}{\delta_n \lambda_n \gamma_n} X^E
\end{aligned} \tag{2.4}$$

Given 2.3 the Norwegian firm will prefer not too search because the search costs exceed the expected gain. But by 2.2, should the Russian firm search, an alternative cost is added to not searching due to the emerging chance of being forced to leave the market. For  $\delta_n > 0,618$  expression 2.4 constitutes a positive lower limit to  $\Delta X^E$  compatible with 2.2.<sup>6</sup> Should  $\Delta X^E$  fall below this value the incentive for the Norwegian firm to search is insufficient to force a *Search-Search* equilibrium. That is to say if the Norwegian firm initially achieves a sufficiently high export price, he will see himself served best by staying even taking into consideration the risk of having to leave the market.

### 2.3.2 Russian Equilibrium Conditions

The Russian conditions for Nash equilibria are computed in the same manner as for the Norwegian firm, keeping in mind that for the Russian firm  $X_m^{AB} = X^{IM} - X^E$  and  $\Delta X_m^{AB} = \Delta X^{E'}$ .

*Nash equilibrium conditions for Search-Search*

$$\pi_m^{22} \geq \pi_m^{12}$$

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<sup>6</sup>The reader might justly ask whether the discount value  $\delta_n > 0,618$  is a plausible one. Perhaps it is not. But on the other hand neither is it plausible that the game ends in  $t + 2$ . Adding more periods to the game would provide more periods of sure profit to be discounted up against possible gain and consequentially a lower the required discount factor.

$$\begin{aligned}
&\Rightarrow \lambda_m \lambda_n (1 - \delta_m - \delta_m^2) (X^{IM} - X^E) + \lambda_m (1 - \delta_m^2 \lambda_n) \Delta X^{E'} \\
&\geq (1 - \lambda_n \delta_m (\delta_m + \gamma_m \lambda_m)) \frac{C_m}{\delta_m}
\end{aligned} \tag{2.5}$$

*Nash equilibrium conditions for Stay-Stay*

$$\begin{aligned}
&\pi_m^{11} \geq \pi_m^{21} \\
&\Rightarrow C_m \geq \delta_m \lambda_m \Delta X^{E'}
\end{aligned} \tag{2.6}$$

*Comparing expressions 2.5 and 2.6*

$$\Rightarrow \Delta X^{E'} \geq \frac{\delta_m^2 + \delta_m - 1}{\delta_m \lambda_m \gamma_m} (X^{IM} - X^E) \tag{2.7}$$

### 2.3.3 Joint Equilibrium Conditions

Expressions 2.2-2.7 implicitly define intervals of  $X^E$  compatible with different static sub-game equilibria. 2.3 defines a lower limit to  $X^E$ . For  $X^E < X_{(2.3)}^E$  *Search* becomes a dominant strategy for the Norwegian player. Equivalently 2.6 defines an upper limit to  $X^E$  for the Russian player. Simultaneously 2.4 defines an upper boundary to  $X^E$  after which *Stay* becomes the dominant strategy for the Norwegian player. 2.7 has the same function for the Russian player. Whereas there is a unique solution to  $X_{(2.4)}^E$ ,  $X_{(2.7)}^E$  leaves one degree of freedom and hence a variable solution dependent on the Russian in market price  $X^{IM}$ .

What I will call the *Stable Relations Equilibrium*, characterized by some  $X^E = X^{E*}$ , is the pure strategies *Stay-Stay* equilibrium and is found along an interval in  $(\underline{X}^*, \bar{X}^*)$  where *Stay* is simultaneously dominant for both players, and along an interval where *Stay* is dominant for the Russian player, though not for the Norwegian player.

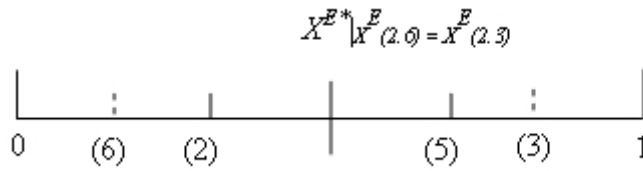


Figure 2.3: Placement of Interval Limits and the Simultaneous Dominance Export Price

The simultaneous dominance interval can be found by first determining the

point where  $X_{(2.4)} = X_{(2.7)}$ . Since  $X_{(2.4)}$  is constant and  $X_{(2.7)}$  is strictly increasing in  $X^{IM}$ ,  $X_{(2.4)} \leq X_{(2.7)}$  for values of  $X^{IM}$  greater than or equal to the value of  $X^{IM}$  for which  $X_{(2.4)} = X_{(2.7)}$ . First we normalize such that  $\underline{X} = 0$  and  $\overline{X} = 1$ .

Then  $\Delta X^E = 1 - X^E$ ;  $\Delta X^{E'} = X^E$ , such that

$$\begin{aligned} 2.4 \rightarrow \left( \frac{\delta_n^2 + \delta_n - 1}{\delta_n \gamma_n} + 1 \right) &= \lambda_n = 1 - X^E \\ \Rightarrow X^E &= \frac{\delta_n \gamma_n}{\delta_n(1 + \delta_n + 2\gamma_n) - 1} \end{aligned}$$

and

$$2.7 \rightarrow X^E = \frac{\delta_m^2 + \delta_m - 1}{\delta_m \gamma_m} \frac{(X^{IM} - X^E)}{\lambda_m} = \frac{\delta_m^2 + \delta_m - 1}{\delta_m \gamma_m} \frac{(X^{IM} - X^E)}{X^E}$$

equating

$$\begin{aligned} \frac{\delta_m^2 + \delta_m - 1}{\delta_m \gamma_m} \frac{(X^{IM} - X^E)}{X^E} &= \frac{\delta_n \gamma_n}{\delta_n(1 + \delta_n + 2\gamma_n) - 1} \\ X^{IM} &= \left( \frac{\delta_n \gamma_n}{\delta_n(1 + \delta_n + 2\gamma_n) - 1} \frac{\delta_m \gamma_m}{\delta_m^2 + \delta_m - 1} - 1 \right) X^E \end{aligned}$$

which yields

$$\hat{X}^{IM} = \left( \frac{\delta_n \gamma_n}{\delta_n(1 + \delta_n + 2\gamma_n) - 1} \right)^2 \frac{\delta_m \gamma_m}{\delta_m^2 + \delta_m - 1} - \frac{\delta_n \gamma_n}{\delta_n(1 + \delta_n + 2\gamma_n) - 1} \quad (2.8)$$

Equation 2.8 defines the lower limit to in market prices for which there exists an export price,  $X^E$ , such that *Stay* is dominant for both players. For the interval where *Stay* is not simultaneously dominant, the Norwegian player is given some liberty to influence the equilibrium. If he appoints a price  $X^E > X_{(2.7)}^E$ , there is no equilibrium in pure strategies.

### Optimal Export Price

The Norwegian player can never set a binding price better than  $X^E = X_{(2.7)}$ . Thus in the absence of simultaneous dominance, profit at the binding price is compared with profit in mixed strategies. This is because the action preferred by both players will depend on which action the other has chosen. We sidestep the mixed strategies equilibrium, but keep in mind the consequences for profit as compared to equilibrium in pure strategies. In mixed strategies the Russian player will play *Stay* and *Search* with probabilities such that the Norwegian

is indifferent between his two strategic choices and *vice versa*. Hence by the conditions for the two Nash Equilibria in pure strategies - any resulting weighted average will yield payoffs less than or equal to payoffs in either of the pure strategies equilibria. This applies to both players.

## 2.4 Renege or Abide?

Prior to period  $t + 1$  the Russian firm consciously compares the expected payoff of her two available actions. If  $\pi_m^{Reneg} \geq \pi_m^{IM}$  the Russian firm defaults on her payment and exits the market completely until the next period. It incurs reentry cost  $\hat{\gamma}C$  and reenters the market in  $t + 2$ .  $\hat{\gamma} \geq \gamma$ , thus  $\hat{\gamma}$  can be given the interpretation as punishment for cheating. In sake of computational simplicity we assume that firms with a repeated default history are identified with out cost so that such behavior brings the firm permanently out of the market. Thus default is not strategically considered for more than one period.  $\pi_m^{OR}$  is out of market profit having reneged. It differs from the general out of market profit by the search cost.

*Formally*

$$\pi_m^{Reneg} = X^{IM} + \delta_m \pi_m^{OR} \text{ where } \pi_m^{OR} = \pi_m^{IM} - \frac{\hat{\gamma}C_m}{\delta_m}$$

Thus

$$\pi_m^{Reneg} \geq \pi_m^{IM} \Rightarrow X^{IM} + \delta_m \left( \pi_m^{IM} - \frac{\hat{\gamma}C_m}{\delta_m} \right) \geq X^{IM} - X^E + \delta_m \pi_m$$

solving for  $X^{IM}$

$$\bar{X}^{IM} \geq \frac{\hat{\gamma}C_m}{\delta_m} + \left( 1 - \frac{1}{\delta_m} \right) X^E + (1 - \delta_m) \pi_m \quad (2.9)$$

2.9 defines an upper limit to the the in market price after which *Reneg* becomes the preferred action for period  $t+1$ . When in market price is sufficiently large short term gains out-weigh the costs. We also see how increased  $X^E$  reduces the threshold.

## 2.5 Predictions

I have built a crude model of Norwegian-Russian trade. It states that stability in trade relations is partly a function of to what degree the cooperative equilibrium can be sustained and partly a function of stability in the cooperative equilibrium

outcome. Stability in the cooperative equilibrium is found along a price interval where both trading parties find their terms of trade sufficiently preferable to not induce search efforts. An export price is more likely to be within such an interval if it is not at the extremes of the export price range depicted in figure 2.3. In the cooperative equilibrium we should thus expect a quadratic relationship between the Norwegian firms pricing strategy and stability in their trade relations with Russian partners.

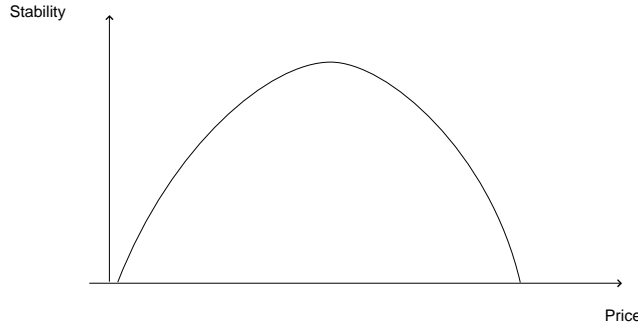


Figure 2.4: Proposed Price-Stability Relationship

### 2.5.1 Stability Inducing In Market Price

There is a positive relationship between in market prices and stability. The higher the Russian firm's profit margin for a given export price, the less likely is she to engage in costly search activities.

$\hat{X}^{IM}$  is the in market price for which there exists an export price  $X^E$  such that *Stay* becomes simultaneously dominant for both players and can be given the interpretation of a stability threshold. As  $\hat{X}^{IM}$  increases, increasingly high in market prices are needed to support long term relations. This is because as  $\hat{X}^{IM}$  increases, a higher  $X^E$  is needed satisfy the Norwegian player which in turn demands a higher in market price for the Russian player to prefer the long run relationship

*Comparative Statics on  $\hat{X}^{IM}$*

$\frac{\partial \hat{X}^{IM}}{\partial \gamma_n} > 0$ ;  $\frac{\partial \hat{X}^{IM}}{\partial \gamma_m} > 0$ : Increased reentry costs make being outside the market more costly compared to search costs and the gain from searching. Thus higher reentry costs make firms less reluctant to abstain from searching and increases the stability inducing threshold. This result is in opposition to general conclusions in sunk cost theory for international trade where the presence of sunk

entry costs is stability enhancing by a hysteresis argument.

$\frac{\partial \hat{X}^{IM}}{\partial \delta_n} < 0$ ;  $\frac{\partial \hat{X}^{IM}}{\partial \delta_m} < 0$ : Increased future value eases the consequences of leaving the market because profits at reentry are given greater weight, making it less urgent to utilize the possibilities of instant gain. An increased discount factor is stability generating since it is the risk of involuntarily leaving the market that induces search activity.

We should expect instability to subside as in market prices increase. Regarding reentry costs as opposed to in market search costs, these are likely to differ across product groups. The model furthermore unfortunately ignores the possibility of multiple trade relations. It might be prudent to expect some effect from multiple trade relations. If a firm is still in the market with other products, its reentry costs could be lower. Firms that export a variety of products might thus be less exposed to instability in their trade. In terms of the model,  $\gamma$  might be function of the number of trade relations a firm has established in the market.

## 2.5.2 Cooperative Equilibrium and the In Market Price

*Comparative Statics on  $\bar{X}^{IM}$*

$$\frac{\partial \bar{X}^{IM}}{\partial C_m} > 0; \frac{\partial \bar{X}^{IM}}{\partial \gamma_m} > 0; \frac{\partial \bar{X}^{IM}}{\partial X^E} < 0; \frac{\partial \bar{X}^{IM}}{\partial \pi_m} > 0 \quad \frac{\partial \bar{X}^{IM}}{\partial \delta_m} \leq 0$$

$\bar{X}^{IM}$  is another threshold. As long as  $X^{IM} \leq \bar{X}^{IM}$  long run loss outweighs short run gain from reneging. Increased search costs increase this threshold because out of market profit depends negatively on the payment necessary to reenter. Not surprisingly, the "penalty" cost from reneging reduces its appeal. Increased  $X^E$  reduces the Russian player's expected gain from present and future transactions making short run gain more inviting. As expected payoff in the cooperative equilibrium increases, the in market price necessary to induce renegation increases. Expected payoff in the cooperative equilibrium increases with the stability in this equilibrium<sup>7</sup>.

The effect of an increased Russian discount factor is ambiguous. On the one hand it increases the value of future loss as opposed to instant gain. On the other hand it increases payoff upon reentering compared to the cost of reentering. It seems reasonable that in practical life the former effect dominates. We should expect an increased Russian discount factor to support the cooperative equilibrium.

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<sup>7</sup>For proof see appendix

## 2.6 Issues

The number of players has not been specified. One could expect that if the number of players in one of the populations were to decrease / increase significantly compared to the players in the other population then it would become harder for players from the abundant population to match. This is true. One might be tempted to make the distribution of prices endogenous on the number of players. I do not feel that this would be the correct approach. The model does not give grounds to predict which firms will exit the market, apart from the fact that firms in the center will experience greater stability. Mass market exit of export firms could have two plausible effects on the price distribution equation 2.1 and figure 2.1. Firstly the upper and lower bounds could change truncating the export price range. Secondly one might experience a lower density of offers in the extremes of the export price range. The second effect, with unchanged upper and lower limits to the export price range, would change the price distribution leading to increased kurtosis. The first and second effect would both make for less gain from search efforts and increased stability. Since the results are the same, one can treat increased kurtosis as a *de facto* truncation of the feasible price interval and stick with the uniform distribution as an approximation. Such an approach avoids unnecessary modeling complications. A significant discrepancy in the number of Norwegian and Russian players could instead be fortunately integrated into the model by increased search costs. An increase in the number of exporters could also potentially distort the distribution if the new firms found it optimal to price mid-range. It seems timely to jump ahead a little and point to figure 3.1. As can be seen from the figure, prices are not uniformly distributed and the choice of uniformity in section 2.2 must be seen as a computational simplification. To the discussion of the effect of changes in the number of players one might add, that although there is some firm and trade level exit and entry, the shape of the price distribution seems to remain relatively unaffected over the years 1996-2004.

While I have chosen a finite game, a repeated game could potentially provide important insights. In particular one could try to identify a system of collective enforcement through a repeated game by the application of folk theorems. An especially interesting concept for our setting is indefinitely repeated games - when the number of stages is not commonly known (eg. Neyman, 1999) . The recent "salmon crisis" between Norway and Russia shows that trade with Russia is subject to political instability. While the game reached its final stage quite unexpectedly for Norwegian exporters, one might expect that Russian importers had some chance to see this coming. Although this type of asymmetric information is interesting, the data at hand does not allow to straight forwardly test

hypothesis' about the Russian players. Repeatedness was therefore sacrificed above to allow for hypothesis' and explanatory variables that could be tested up against data. It would be possible to model the game above as a repeated one, but this would not lead to testable results different from the ones already in the model.

On the micro-level firms should be able to achieve stability by avoiding extreme pricing behavior. If all Norwegian realize this and find such behavior optimal as proposed by the model, then on the macro-level, one should expected export prices to converge as firms learn the rules of the game. The model only treats firms' first few periods in the Russian market. Obviously the story of the Russian market for Norwegian seafood does not end after period  $t + 2$ . A natural extension of the model is that if players are able to learn the rules of the game, one should experience price convergence in result. Jumping ahead again to figure 3.9, the price convergence prediction seems to be accurate. Hence the assumption of uniformly distributed prices over time seems seems a rather far fetched one. Unfortunately incorporating such changes in players' beliefs over time would be prohibitively complicated and is one of the reasons the model is not modeled as a repeated one. One of the major faults of the model is that it does not tell a full story but limits it self to pointing out a direction for the empirical analysis.



## Chapter 3

# Empirics

### 3.1 Data and Methodology

At hand is an extensive set with data for all Norwegian fish exports for the years 1996-2004. In its raw form it consists of more than 57 000 observations on 1069 firms exporting 297 goods to 200 countries in the years 1996 - 2004. Each observation is identified by the firm exporting and which product it exports. One firm may export several products. This results in several observations will the same firm identification. I will investigate only exports going to Russia. In this reduced form the data set counts 2797 observations. Reshaping the data set into long form such that for each firm-product pair there is a separate observation for each year leaves over 24 000 observations.

The goal of this chapter is to try to detect which, if any, factors influence stability. To this end I define a trade as the export of a certain good by certain firm. A trade is defined for all years so it may repeat itself throughout the period.

If one is to link the present data to the model in chapter 2, the actual observations must be assumed to represent realizations of the cooperative equilibrium described in section 2.3. In chapter 2 the cooperative equilibrium was characterized by a pair of strategies, and the potentially observable result where one or both players stay in or leave the market. In this case it seems tractable to measure stability along the time-trade dimensions, as the probability of leaving the market at any given time. Using a binary variable for exit one could apply probit analysis to investigate what increases the chance of a trade falling out of the market at any given time.

On the other hand as the outcome of trade in this equilibrium was modeled to be probability driven, one can only hope that the true distribution of severed trade will be revealed by repeated observations over time. Thus it seems

appropriate to model the stability of a trade measured over some time period as a function of the history of strategic choices with respect to price and external factors such as growth in domestic demand. Such an approach creates an econometric challenge because in the empirical model the left-hand endogenous variable will be measured along one dimension - on the trade level, while the right-hand exogenous variables are measured along two dimensions - trade and time. Alternatively one could choose to generate the mean of variables such as price and GDP growth across across time removing one dimension from the right-hand variables. Such an approach though would abstract from the notion that overall stability is a function of a set of strategic choices that each are made in a separate time period conditional on the external conditions specific to that particular time period.

Since generating means across time does not qualitatively effect regression results and the idea that time specific strategic choice effects stability aggregated over time is central, I choose to stick to measuring stability over time and keeping the specific prices, observation of GDP growth for each year as separate observations. I suggest interpreting the year-wise realizations of each trade as separate transactions. Each transaction constitutes a separate observation and is linked up to the stability measure of the trade to which it belongs. Thus the following regressions investigate whether there is a link between the properties of each transaction and the stability of which they are a part. A more detailed discussion is provided in section 3.5.

The main hypothesis' are:

- H 1 Stability is negatively affected by deviations in price from the market mean
- H 2 Sunk costs have a negative affect on stability. This hypothesis will be tested be means of proxies
- H 3 Growth in domestic demand positively affects stability
- H 4 There are other time specific effects at play that are not identifiable in the data - possibly improved institutions

For expositional reasons the variables in addition to price are presented in separated regressions. A control regression for multi collinearity is provided in table B.1.

## 3.2 The Empirical Model

The dependent variable in the model is  $S_i$ , a measure of trade stability. It represents the number of years a given trade was positive relative to potential

years of positive trade. The idea is to investigate the determinants of trade stability.  $S_i$  is discussed more closely in section 2.6

The model in chapter 2 gave grounds to expect a quadratic relation between a firm's price strategy and the stability. We also saw how stability might depend on the cost of establishing a trade relation when one is out of the market, i.e. has no partner, compared to the cost of establishing a new relation when one is in the market.

Accordingly I choose to estimate the following econometric model:

$$S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2 + \beta_i \mathbf{X} + e_i \quad (3.1)$$

The quadratic form in equation 3.1 is chosen because the theoretical model presupposed that deviations from mean market price both to the left and to the right of the export price distribution resulted in decreased stability. In equation 3.1 stability will increase for some interval of  $P_i$ , reach a maximum and then decrease.

The alternative log-specification of equation 3.1 would render a concave, but monotonically increasing, relation between stability and export price. The log specification would ensure the effect of increasing price to satisfy the exporter's incentive constraint, but does not allow finding a maximum with respect to price without introducing the importer's incentive constraint as constraint to the maximization problem. This feature is already internalized in the current specification of equation 3.1. Although I do not explicitly provide the exporter's maximization problem, the current specification of equation 3.1 seems accurate enough and more tractable compared to the log-alternative. Especially if one takes into consideration the relationships presupposed in chapter 2. From an empirical point of view the quadratic form also provides better fit.

The variables signify:

- $S_i$  - Stability in exports.  $S_i$  is a measure of each individual transaction and is equal to the overall stability measure of trade to which the transaction belongs. Hence  $S_i$  is calculated on the trade level.

$$S_i = \frac{\sum t \leftrightarrow v_{\tau t} > 0}{T - (t * -1)} \quad (3.2)$$

$t$  period denominator,  $t*$  entry year,  $\tau$  trade denominator;  $v_{\tau t}$  trade value at time  $t$ ;  $T$  total periods in the sample,  $T = 9$ .

- $P_i$  is price the at which each transaction was realized, relative to the

average price of that good in the Russian market at the given time.

$$P_i = \frac{p_i}{\frac{1}{n} \sum_{f=1} p_{fkt}} \quad (3.3)$$

Subscript  $i$  is the transaction identifier and is a combination of firm, product and time identifiers  $f, k$  and  $t$ . Thus transaction prices in the denominator are summed across firms exporting product  $k$  in time  $t$ .

For each firm there are observed a number of prices - one for each product exported. These prices constitute a firm's price strategy.

- $\mathbf{X}$  is a vector of supplementary explanatory variables and is meant to capture most notably cost and time effects.

After entry, exit and time in the market have been quantified observations of zero trade were removed. The observations of zero trade yield missing values for price and hence also for relative price and are thus not included in the regression analysis. Removing these observations was done to simplify gaining an overview of the data.

The expression for relative price is based on a simple and not weighted average. Using a simple average often leaves the results of empirical analysis prone to distorting effects disturbances in the data. To avoid unnecessary noise analysis is based on a truncated data set. Firm level trade data are at special risk of measurement errors. Manually inserted data can easily be registered wrongly with an extra zero or so. In aggregated trade data the effect of such typos is reduced - this is not the case here. To avoid the worst measurement errors I base my analysis on observed values of relative price within a 98 % confidence interval around the observed mean. The observed mean and standard deviation of relative price are 0.996 and 0.4339. Assuming the  $P_i \sim N(1, 0.44^2)$ , 98 % of observed relative prices should be in the interval  $(1 - (0.44 \times 2.3056), 1 + (0.44 \times 2.3056))$  or  $(-0.01, 2.01)$ . As the interval's left limit goes beyond 0, only values of relative price above 2 are removed from the data prior to further analysis.

After missing values had been removed, 118 observations displayed a relative price of more than 2. 5101 observations stayed within  $(0, 2)$ . Figure 3.1 shows the distribution of relative price in this range. In the following, regressions will be based on the part of the data where relative price is in the discussed interval.

A weighted average where the trade's contribution to overall export value for a given product was taken into consideration could be an option but has not been chosen for the following reasons.

Since stability in the model is measured trade wise indifferent to the value the trade is seems natural that the average price be measured also on this level.

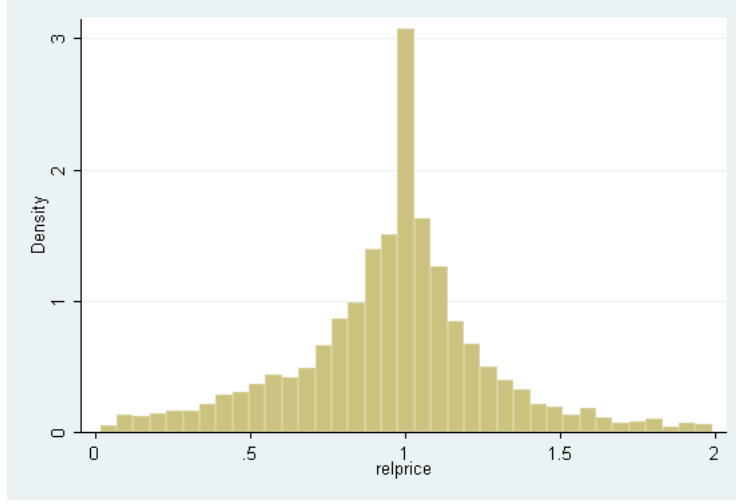


Figure 3.1: Distribution of Relative Price for  $P_i \in (0, 2)$ , STATA 9.0

Taking a weighted average and measuring the de-facto market price can be argued to be a departure from the assumption that the trade flow reported by one firm for one product is in fact one trade. A weighted average would act as a confession that the "trades" with large value are in fact many trades. I choose to stay loyal to my initial assumptions. Further more involving trade size into the equation might attract disturbance by some spurious effects since stability in practice very well might be dependent on size and size does appear explicitly in the model but would appear in the expression for relative price. In the model in chapter 2 I studied trade, the size of which was normalized to unity. A simple average is based on the price of a trade when it has been normalized to unity is suitable and is considered to be a satisfactory measure since the most extreme observations have been removed.

### 3.3 Regressions

#### 3.3.1 Price Strategy and Stability

Regressing the chosen continuity measure on relative prices and squared relative prices yields a relationship in line with the theoretically anticipated one. As can be seen from the regression results in table 3.1 the coefficient of price is positive, whereas the coefficient of squared price is negative. Both are significant at the 0.01 level. This one dimensional model does not display a convincing goodness of fit,  $R^2 = 0.037$ . Nevertheless we find support in the data for the relationship illustrated in figure 2.4. Figure 3.2 shows the empirical relationship.

Table 3.1:  $S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2$ 

Variable	Coefficient
	(Std. Err.)
relprice	0.695** (0.047)
sqrelprice	-0.323** (0.024)
Intercept	0.199** (0.023)
N	5101
R <sup>2</sup>	0.043
F (2,5098)	113.308
Significance levels : † : 10%   * : 5%   ** : 1%	

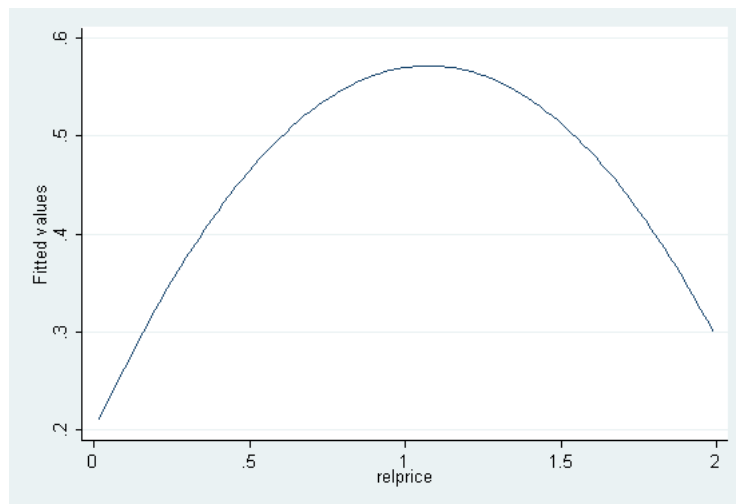


Figure 3.2: Relationship between Stability and Relative Prices as proposed by STATA 9.0

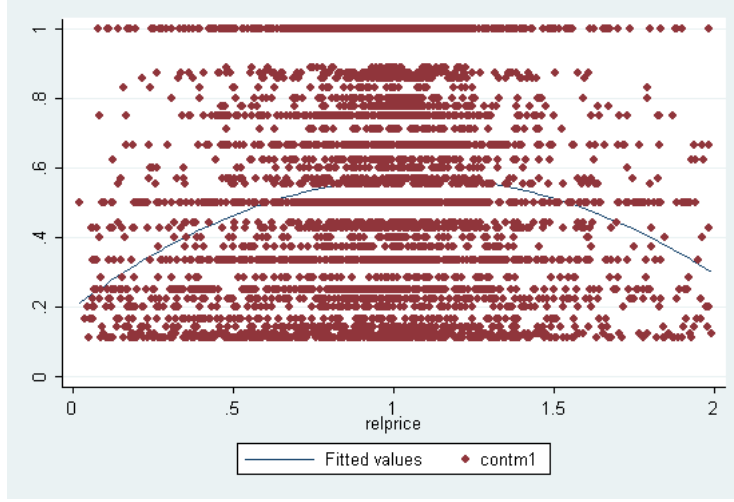


Figure 3.3: Relationship between Stability and Relative Prices as proposed by STATA 9.0

If we add a scatter plot of the observations to the fitted values curve, figure 3.3, we see that price does not tell us the whole story behind trade stability.

### 3.3.2 Cost Effects

In section 2.5 we saw that stability was modeled to depend negatively on cost of establishing a trade relation when out of the market relative to establishing a new relation when in the market. This was due to the fact that if player  $n$  when in the market did not search this could render *Search* optimal for  $n$ 's partner  $m$ . Such a strategy might bring  $n$  out of the market, a prospect that becomes increasingly costly as the out of market search cost increases. Strategy *Search* would at least reduce the chance of leaving the market. Such a line of argument applied equally to both players and thus increased out of market search costs leads to more searching activity on behalf of both players. Departing from the model most firms are likely to be involved in more than one trade. If trade is broken off in one trade these firms do not necessarily fall out of the market. Reestablishment costs might be less for trades conducted by firms who are involved in several trades. Firms that are in the market in many trade i.e. with many products should experience some learning effects reducing reestablishment costs. Thus we might expect trades conducted by firms who are involved in several trades to be more stable.

Table 3.2 displays the regression results when the core regression has been extended to include the number of trades the trading firms is involved in. The variable *NOT* is the number of observed trades per firm in a given year.

Table 3.2:  $S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2 + \beta_3 NOT_i$ 

Variable	Coefficient (Std. Err.)
relprice	0.693** (0.046)
sqrelprice	-0.315** (0.023)
notrades	-0.002** (0.000)
Intercept	0.214** (0.023)
<hr/>	
N	5101
R <sup>2</sup>	0.049
F <sub>(3,5097)</sub>	87.318

The coefficients from the core regression have the same sign as in table 3.1 and are highly significant. But  $\beta_3$  comes out with a significantly negative coefficient. Empirically, increased participation in the export market on behalf of the Norwegian firm seems to have a negative effect on stability of the particular trade over time. This result is in opposition to the predictions made in section 2.5. One reason in compliance with traditional sunk costs theory might be that fish exports are generally characterized by relatively low sunk costs and the export markets are therefore prone to a significant entry-exit activity. Such behavior might be particular to firms who are involved in several trades, which would explain the negative effect on stability. It must be mentioned that in the control regression in table B.1 the coefficient for  $NOT_i$  comes out insignificant.

Proxying an unknown cost structure is not an easy task with the data at hand. Bernard and Wagner (1998) find that in addition to sunk costs that must be incurred by all firms, there are also several firm specific effects that influence the chance of entering the export market. In our case a firm's experience from the Russian market, might serve as such a firm specific effect. Relying on learning effects to reduce sunk costs of market entry the length of a firm's involvement in the Russian export market should have a positive effect on reducing such sunk costs. Medin (2006) finds that being in the market one year increases the chance of being in the market next year by 13-53 % this is in line with findings in Roberts and Tybout (2006). Although it is quite tempting to attribute such results to the hysteresis argument, Melchior (2006) comments that the results also could be an effect of learning processes. One could choose to create an explanatory variable equal to the difference between a trade's entry and exit year. But one



would be creating a variable algebraically linked to the dependent variable and and no doubt significant results without economic sense. Experience in the market is therefore measured on the firm level. The results from a regression taking into consideration the firms' time experience in the Russian market is given in table 3.3. The variable *timeinmark* is the firm's overall exit year from the Russian market less its initial entry year.

Table 3.3:  $S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2 + \beta_3 \text{timeinmark}_i$ 

Variable	Coefficient (Std. Err.)
relprice	0.638** (0.045)
sqrelprice	-0.300** (0.023)
timeinmark	0.028** (0.002)
Intercept	0.086** (0.023)
N	5101
R <sup>2</sup>	0.101
F (3,5097)	190.081

As could be expected  $\beta_3$  in table 3.3 is significantly positive. If firms learn from being in the market over time, reducing sunk costs - then reduced sunk costs, in our context search costs, lead to increased stability.

### 3.3.3 Time Effects

The data is clearly influenced by the developments in the Russian economy in the period covered by the data. Norwegian fish exports fell as the Russian economy plunged as consequence of the 1998 financial crisis. To help in understanding what effects might be in play over time it is useful to take a look at what happened in this time period.

Figure 3.4 illustrates the dynamics of Russian GDP growth. In 1998 Russia experienced negative growth. In the following years growth has been stably high after an initial boom. The initial boom in 1999 was to certain extent the result of more favorable terms of trade because of the recent devaluation. But in more recent years much of the initial exchange rate advantage has been eaten up by a continuous strengthening of the rouble (OECD 2006). Soaring oil prices have helped the Russian economy maintain a budget surplus, but in recent years growth in the Russian economy has become steadily more driven

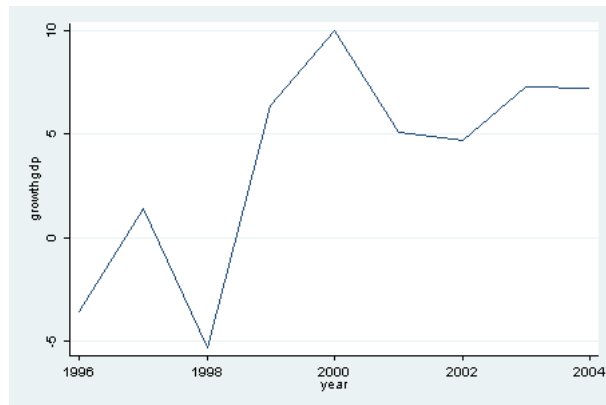


Figure 3.4: Growth Rates of Russian GDP 1996-2004 STATA 9.0

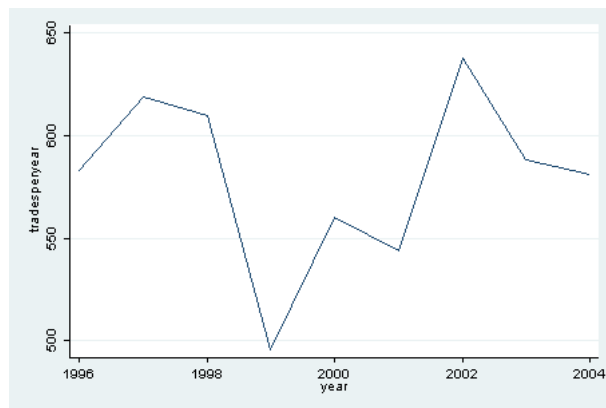


Figure 3.5: Number of Trades per year 1996-2004 STATA 9.0

also by consumer demand (World Bank 2004, 2006). This increase in domestic demand is noticeable also in the Norwegian fish export data.

The corresponding dynamics for the number of trades being concluded and the mean value of this trades are illustrated in figures 3.5 and 3.6. The number of trades being concluded fell in 1998 and regained its previous size shortly after. The number of trades has since then remained stable on its pre-1998 level. The mean value of each trade also slumped in 1998, but in opposition to the number of trades it has increased steadily in course with the growth in Russian GDP.

Increased growth of GDP has a positive effect on stability in our sample, as can be seen from table 3.4. Adding the GDP growth as an explanatory variable has also increased goodness to fit to 0.2. Section 2.5 stated among other that stability is positively related to the in market price, i.e. Russian domestic demand. This was because increased in market prices increases the Russian importer's profit margin making it less attractive to incur search costs.

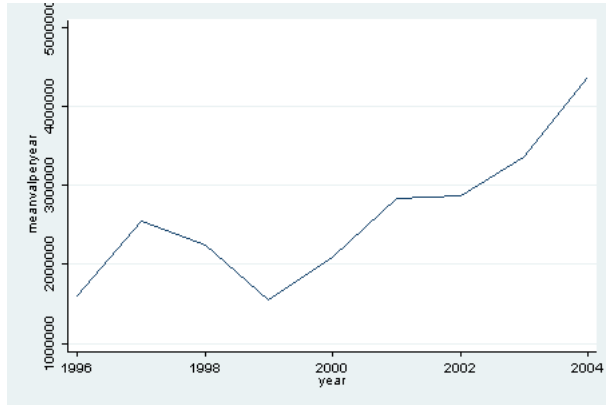


Figure 3.6: Mean Trade Value 1996-2004 STATA 9.0

Table 3.4:  $S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2 + \beta_3 \text{growthgdp}_i$ 

Variable	Coefficient
	(Std. Err.)
relprice	0.627**
	(0.042)
sqrelprice	-0.291**
	(0.021)
growthgdp	0.025**
	(0.001)
Intercept	0.142**
	(0.021)
N	5101
R <sup>2</sup>	0.208
F (3,5097)	447.357

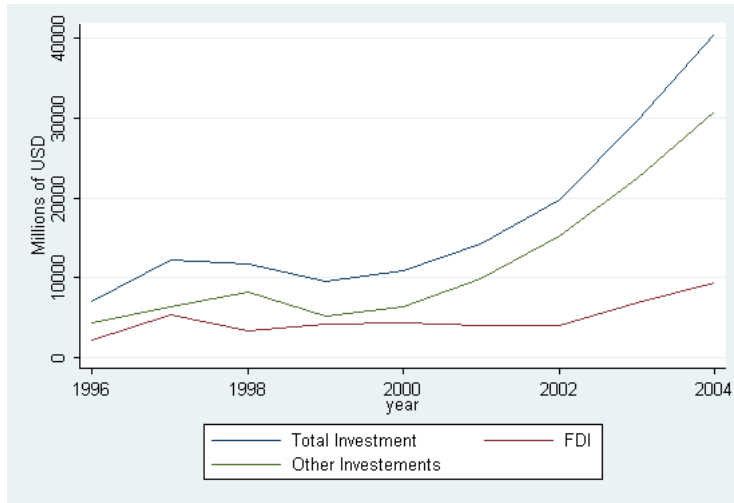


Figure 3.7: Foreign Investment in the Russian Federation (Inflow) 1996-2004: Source GKS, Russian Federal Statistics Service, STATA 9.0

Accepting GDP growth as a proxy for domestic demand offers support to the findings of the model in chapter 2.

Changes in GDP growth rates is not the only interesting development in the Russian economy. As can be seen from figure 3.7 foreign investments have soared since 1999. Interestingly FDI does not maintain its share in the investment activity. While the FDI inflow has remained surprisingly stable, foreigners have been increasingly willing to provide various credits - the main component of "Other Investments" (see figure 3.8). What has made Russia more credible? Recent relative economic prosperity and the accompanying increased solvency is sure to provide some of the explanation, but perhaps we are also witnessing a perception that lawlessness has decreased since the turbulent nineties? On the other hand the fact that FDI has not increased together with credits might indicate that institutions have not improved. In any case it might prove fruitful to add dummies for pre- and post-crisis periods to identify any net effect of time reflecting qualitative changes that are hard to identify. Such changes *might* for instance be linked to more efficient institutions. Table 3.5 contains the results from the regression in table 3.4 after adding the mentioned dummies.

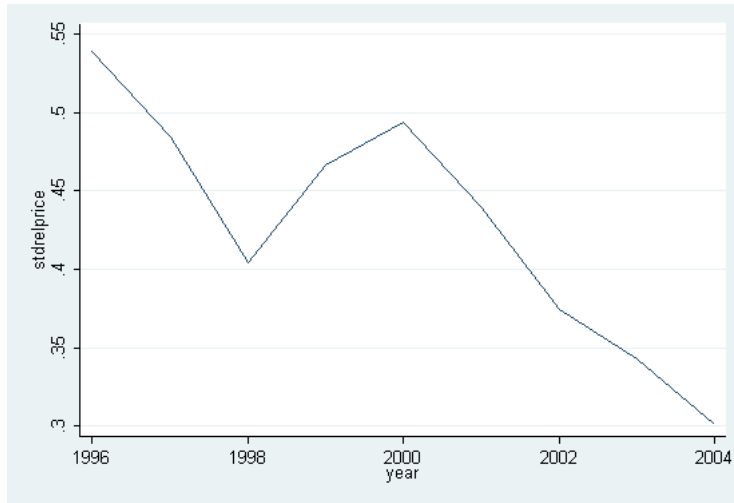
Table 3.5 reproduces statistically coefficients for all variables and a further increase in goodness to fit,  $R^2 \approx 0,3$ . Claiming that institutions are behind the significant  $\beta_4$  and  $\beta_5$  would be jumping to conclusions. Nonetheless stability does in fact increase with time, although we may be facing one of the deficiencies of the chosen stability measure. See section 2.6 for comments on this.

	1995	1996	1997	1998	1999	2000	2001	2002	2003
Total Investments	100	100	100	100	100	100	100	100	100
of which:									
FDI	67,7	35,0	43,4	28,6	44,6	40,4	27,9	20,2	22,8
of which:									
Capital Investments	48,8	25,5	17,3	10,6	12,2	9,7	8,9	8,6	7,6
Credit from foreign coowners	11,4	6,5	21,4	14,4	19,6	25,0	14,8	6,6	7,1
Other	7,5	3,0	4,7	3,6	12,8	5,7	4,2	5,0	8,1
Potfolio Investment	1,3	1,8	5,5	1,6	0,3	1,3	3,2	2,4	1,4
of which:									
stocks and shares	0,4	0,6	4,6	0,3	0,3	0,6	2,3	1,4	1,2
obligations	0,9	1,2	0,9	1,3	0	0,6	0,7	0,7	0,1
Other Investments	31,0	63,2	51,1	69,8	55,1	58,3	68,9	77,4	75,8
of which:									
Trade Credit	6,3	5,8	1,9	14,2	15,2	14,1	12,9	11,3	10,0
Other Credit	16,5	39,0	35,4	53,5	35,0	43,2	55,4	65,4	64,7
Misc	8,2	18,4	13,8	2,1	4,9	1,0	0,6	0,7	0,6

Figure 3.8: The Structure of Foreign Investment in the Russian Federation 1995-2003: Source GKS, Russian Federal Statistics Service

Table 3.5:  $S_i = \beta_0 + \beta_1 P_i + \beta_2 P_i^2 + \beta_3 \text{growthgdp}_i + \beta_4 \text{pre98} + \beta_5 \text{post00}$

Variable	Coefficient
	(Std. Err.)
relprice	0.525**
	(0.040)
sqrelprice	-0.241**
	(0.020)
growthgdp	0.004**
	(0.001)
pre98	-0.122**
	(0.011)
post00	0.204**
	(0.012)
Intercept	0.175**
	(0.021)
N	5101
R <sup>2</sup>	0.306
F (5,5095)	449.448

Figure 3.9: The Standard Deviation of *relprice* 1996-2004, STATA 9.0

### A Comment on Strategic Learning

The model in chapter 2 states that stability can be achieved by choosing an export price  $X^E$  that is profitable enough for the Russian importer to ensure that *Stay* as the dominant strategy. A feasibility condition for the existence of such a price was that it ensured *Stay* dominance also for the Norwegian exporter. The model did not state however what would happen when Norwegian and Russian players came to know the rules of the game. Departing from the model it is reasonable to expect that as time goes on players will start to understand the different stability constraints and start to price closer and closer to such a binding export price. In section 2.5 the stability inducing export price was claimed to be close to the center of the export price distribution. If players learn the rules of the game one should expect them to price closer and closer to the mean export price, i.e. that the standard deviation of relative price decrease with time implying a more peaked distribution of relative price. As can be seen from figure 3.9 the standard deviation of the variable *relprice* does in fact decrease, though not monotonically, over the time period. If players are consciously pricing closer to the mean export price in order to effect stability, then learning the rules of the game provides an alternative explanation for the signs of  $\beta_4$  and  $\beta_5$  in table 3.5. Perhaps this type of learning also lies behind the positive  $\beta_3$  in table 3.3.

### 3.4 Conclusions

Through out chapter 3 I have investigated by means of OLS the determinants of trade level stability in Norwegian fish exports to Russia in the years 1996-2004. The point of departure has been predictions from the a theoretical model built in chapter 2. This model focused on incentive compatible constraints as stability determinants and the ability of Norwegian exporters to influence stability through strategic pricing. The model's main conclusion in respect to this last strategic element was that stability increased as the export price approached the mean price and decreased as one moved away from the center of the distribution.

The predictions about the effect of strategic behavior have served as the basis of empirical analysis throughout the chapter. After an initial regression with only relative price as the explanatory variable, different components of the incentive constraints summarized in section 2.3.3 were added. Variables such as the number of trades a firm was involved in and the overall time the firm had been in market were added to proxy the firms sunk search costs - a major determinant of the firms choice whether to stay with its current partner or to search for a new one. Russian GDP growth was added to proxy domestic demand, another stability influencing effect.

The coefficients of relative and squared relative price remained significant with the expected signs throughout all the regressions. The number of trades a firm was involved in was found, contrary to what was expected, to have a negative effect on stability. But its effect proved insignificant in regression with all explanatory variables conducted as a control for multi collinearity. The overall time a firm had been in the market had a positive effect on stability. These variables were added under the argument that as exporting firms are active in the Russian export market they learn and thus face less sunk search costs when temporarily out of the export action. In line with chapter 2 this reduces search activity on behalf of the Norwegian exporter and increases stability. The growth rate of GDP was also found to have a positive effect on stability. In chapter 2 increased in market price  $X^{TM}$  increased the profit margin of the Russian importer and reduces the attractiveness of searching for a new partner - increasing stability.

Furthermore regressions found that there were time specific effects at play net of GDP growth. Dummies for pre- and post-crisis periods showed a negative and positive effect on trade level stability. The link to improved institutions was discussed as a possible explanation. Although such an explanation seems probable, especially in the light of improved Russian creditworthiness, the absent increase in FDI points in a different direction. The following alternative

explanation was launched. As firms come to know the market and the rules of the game, they increasingly price in a binding way - increasing stability. Since the Russian export market is a relatively young one taking into consideration that it opened only 15 years ago and the changes that have taken place since, the Norwegian firms' learning will inevitably be correlated to time. Such a prospect also brings in a supplementary interpretation of the effect of firms' experience, over time, in the Russian export market. Alternatively we might be witness to a tâtonnement process in a maturing market where exporters offering disequilibrium prices fall out of the market and reenter offering prices closer to equilibrium. Elaborating such an approach could explain both the price convergence and increasing stability observed in the data.

All variables were shown to have a significant effect on trade level stability. Most variables also had the expected sign. One exception was the firms' product involvement in the Russian market. Regressions in chapter 3 generally support the causal relations indicated in chapter 2. But many of the effects from the theoretical model could not be proxied by the data at hand. One should furthermore be careful to conclude that the variables from the empirical analysis in fact reflect the effects they are meant to. More work in this field is sorely need, but it is unfortunately not within the scope of this paper to embark on such a task.

## 3.5 Issues

### 3.5.1 Measurement level of $S_i$ versus the measurement level of independent variables

Above I mentioned issues arising from the fact that the left-hand dependent variable is constructed as measure of stability over time, while the right-hand explanatory variables are time specific. The option of aggregating also these across time was mentioned. The core issue is that while one really has one observation per trade with one corresponding stability measure and several observations of price - one for each year, the way of treating the data as is suggested here treats each observed price as if it belonged to a separate observation. A trade that exists for 3 years is treated not as one, but as three observations. Price could also be aggregated across these 3 years, but apart from the intuitive objection mentioned above there are also some technical difficulties with this approach.

In the following regressions time dummies are introduced to identify qualitative effects apart from difference in purchasing power associated with doing business in Russia in the pre- financial crisis period in opposition to doing busi-



ness in the post-crisis period. A trade that has a history extending across these two periods would end up with different values of the dummies depending on the year at question hence both reducing the data set to containing the "true" amount of observation still leads to duplicate observations - and no essential change compared to the initial situation. Reshaping the data set is also complicated by the variables that do not have a separated observation for each year, but also do not have a fixed value for all years.

To side-step this issue I suggest interpreting the year-wise realizations of each trade as separate transactions. Each transaction constitutes a separate observation and is linked up to the stability measure of the trade to which it belongs. Thus the following regressions investigate whether there is a link between the properties of each transaction and the stability of which they are a part. Table B.2, appendix B provides a control where price, GDP growth and number of trades have been aggregated across time. As can be seen from the regression, results do not strongly differ from the ones presented in the regressions above. Thus it seems that the chosen approach can be accepted.

### 3.5.2 Comments on the Stability Measure $S_i$ - firm entry and final exit

The stability measure  $S_i$  is based on the number of total nonzero trades since market entry. Such a measure is biased towards firms who enter into a trade late. These firms will have a small denominator in their stability measures, see expression 3.2. Trades with entry early in the period of scrutiny will have high denominators. The possibility of overall market exit increases the predicament. A trade that entered the market in 1996 and left after 4 years because of bankruptcy, takeover or other would have an unfairly low stability measure. Despite the present measures faults the closest substitute is not necessarily much better. An alternative could be to replace the denominator in 3.2 with actual time in the market - final exit year minus entry year. Such an approach though would be biased towards "one shot wonders". Trades that are initiated and permanently terminated one or two years later would receive a high stability score, yet it is hard to argue that such behavior defines stability. Figure 3.10 takes a look at entry and exit into the Russian export market. As before entry and exit is counted on trade, not firm level.

As we see from figure 3.10 there are many entries in the beginning of the period and fewer as time goes on. Conversely the number of exits is low in the beginning, but picks up towards the end of the period. The overall number of trades remains stable through out the period. As to  $S_i$ , the entry-exit dynamics are quite reassuring since it would be the opposite development that would have

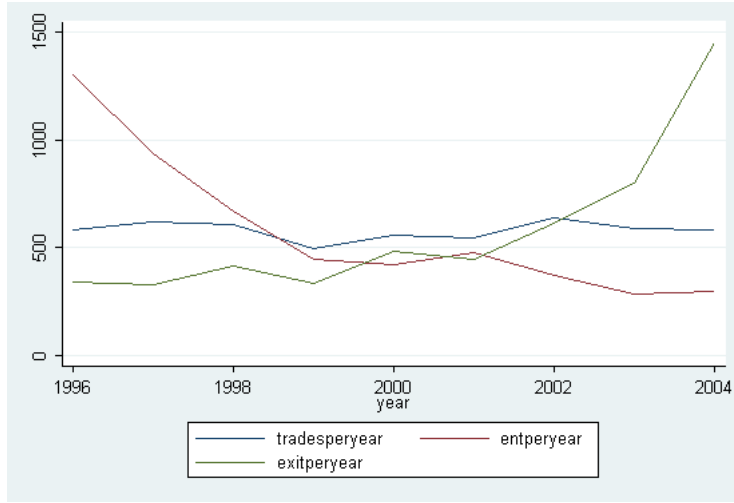


Figure 3.10: Entry and Exit Dynamics 1996-2004, STATA 9.0

fueled the bias discussed in the paragraph above. If lots of firms were exiting early one would end up with artificially low stability measures. As can be seen from figure 3.10 this is not the case.

### 3.5.3 Assumptions on the residuals $e_i$

When conducting regression analysis on any empirical material one is at risk that the assumptions implicit in regression analysis regarding the model's residuals do not hold.

The assumptions at question are:

A 1  $E(e_i) = 0$

A 2  $var(e_i) = \sigma^2 = var(S_i)$

A 3  $cov(e_i, e_j) = cov(S_i, S_j) = 0 \leftrightarrow i \neq j$

The expectancy of  $e_i$  in the regression displayed in table B.1 is very close to zero, although significantly, statistically speaking, larger than zero. Figure B.2 provides an illustration. Figure B.3 shows that the residuals of this regression plotted against fitted values. We see that although residuals are seemingly dispersed over an equal area or have equal variance, the mean seems to decrease with predicted level of stability,  $\hat{S}_i$ . Although we don't find direct evidence of the fact that assumption A 2 is violated, we do seem to find that the model systematically overestimates stability for trades with a low stability measure and vice versa for trades with a relatively high stability measure. This is in apparent violation of A 3. It might therefore be worth while to search for variables over

which to cluster the data. This particular behavior on behalf of the residuals might also be related to the aggregating of  $S_i$ . It is unfortunately beyond the scope of this paper to investigate these issues further.

## Chapter 4

# Results

In chapter 1 I argued that trade between Norway and Russia suffered from *Institutional Incompatibility*. Although the two countries might have contract enforcing mechanisms that ensure the efficiency of trade within the countries, these contract enforcing mechanism do not apply in the same degree to cross border trade. Inability to enforce contractual agreements for more than one period ahead was chosen as a stylized example of this notion.

The results of imperfect contract enforcement were elaborated on in a formal model in chapter 2. The main contribution of this model was to point out a new dimension of the fact that there are two ends to the deal also in international trade. Players were given among other the option to stick with their current partner in a long run relationship, two periods, or search for a new partner after one period. The main results were:

1. The stability in trade experienced by Norwegian exporters can be affected by their strategic considerations regarding export price. Optimal pricing with respect to trade stability would imply pricing in the mid-range of the export price distribution.
2. Sunk out of market search costs may have a negative influence on trade stability. This was because if out of market search costs were high, players found it optimal to search in face of an increased chance of leaving the market due to unilateral search activity from their opposing player.

Chapter 3 saw an empirical treatment of trade stability based on data for Norwegian seafood exports to Russia. The implied price-stability relationship was found consistent with the data and the coefficients of relative price and squared relative price remained significant throughout a series of regressions. There was some evidence that reduced search costs increased stability. However

the distinction between out of market search costs and in market search cost was not drawn and the positive effect of a firm's experience in the Russian market may be a result of learning the rules of the game and utilization of strategic pricing rather than reduction in out of market search costs through learning. Improved stability was closely associated with time. As the years passed trades seemed to become increasingly stable. There are several possible explanations of this result. Among those that were discussed, growth in Russian GDP and consequentially Russian demand for Norwegian seafood is the explanation that has the closest link to the model in chapter 2. Increased domestic demand increases the profitability for importers from any trade making it less urgent to seek better terms of trade.

It was shown that there are time effects at play also net of GDP growth. The quality of Russian contract enforcement institutions may have improved. Contracts might not be as costlessly breached as in earlier times. Recent increases in foreign trade credit and other credit to Russia indicate that this may be the case. Of course increased creditworthiness is inevitably linked to improved solvency. Interestingly; while the number of firms and trades being executed in the market have returned to pre-crisis levels and the mean value of trades continues to grow, the variation in export prices has decreased significantly. Although this might be the result of increased competition as the Russian market matures, the Russian market has not witnessed an increase in firms and only a slight increase in trades. Price convergence need thus not be the result of reduced market concentration. The question remains unanswered whether Norwegian firms have learned to price optimally so as not to induce unwanted search behavior.

This paper has focused on the need for Norwegian firms to strategically handle differences in institutional structure between Norway and Russia. The formal model showed that strategic thinking *could* influence trade stability and that this line of research should not be ignored. The empirical analysis found support for the ideas laid out in preceding chapters.

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## Appendix A

# Mathematical Appendix

### A.1 Solving for Out of Market Profit in the *Search-Search* Equilibrium for Player $i$

$$\pi_i^{OM} = \delta_i(\pi_i^{IM} - \frac{\gamma_i C_i}{\delta_i})$$

and

$$\pi_i^{IM} = X_i^{AB} + \delta_i \pi_i$$

inserting  $\pi_i^{IM}$  in  $\pi_i^{OM}$ :

$$\pi_i^{OM} = \delta_i \left( X_i^{AB} + \delta_i \pi_i - \frac{\gamma_i C_i}{\delta_i} \right)$$

now insert equilibrium specific profit  $\pi_i^{22}$ :

$$\pi_i^{OM} = \delta_i \left( X_i^{AB} + \delta_i \left[ \lambda_i (X_i^{AB} + \Delta X_i^{AB}) + (1 - \lambda_i) (\lambda_j \pi_i^{OM} + (1 - \lambda_j) X_i^{AB}) - \frac{C_i}{\delta_i} \right] - \frac{\gamma_i C_i}{\delta_i} \right)$$

collecting terms:

$$\pi_i^{OM} (1 - \delta_i^2(1 - \lambda_i)\lambda_j) = (\delta_i + \delta_i^2 - \delta_i^2(1 - \lambda_i)\lambda_j) X_i^{AB} + \delta_i^2 \lambda_i \Delta X_i^{AB} - (\gamma_i + \delta_i) C_i$$

define  $H = \delta_i + \delta_i^2 - \delta_i^2(1 - \lambda_i)\lambda_j$  and  $K = 1 - \delta_i^2(1 - \lambda_i)\lambda_j$

$$\Rightarrow \pi_i^{OM} = \frac{H}{K} X_i^{AB} + \frac{\delta_i^2 \lambda_i}{K} \Delta X_i^{AB} - \frac{\gamma_i + \delta_i}{K} C_i$$

## A.2 Nash Equilibrium Conditions for *Search-Search*

Norwegian firm:

$$\begin{aligned} \pi_n^{22} \geq \pi_n^{12} &\Rightarrow \lambda_n (X^E + \Delta X^E) + (1 - \lambda_n) (\lambda_m \pi_n^{OM} + (1 - \lambda_m) X^E) - \frac{C_n}{\delta_i} \geq \lambda_m \pi_n^{OM} + (1 - \lambda_m) X^E \\ &\rightarrow \lambda_n \Delta X^E + \lambda_n \lambda_m (X^E - \pi_n^{OM}) \geq \frac{C_n}{\delta_n} \end{aligned}$$

Insert  $\pi_n^{OM}$ :

$$\begin{aligned} \lambda_n \Delta X^E + \lambda_n \lambda_m \left( X^E - \frac{H}{K} X^{AB} + \frac{\delta_n^2 \lambda_n}{K} \Delta X^{AB} - \frac{\gamma_i + \delta_i}{K} C_i \right) &\geq \frac{C_n}{\delta_i} \\ \lambda_n \lambda_m \frac{K - H}{K} X^E + \frac{\lambda_n (K - \delta_n^2 \lambda_n \lambda_m)}{K} \Delta X^E + \frac{\lambda_n \lambda_m (\gamma_n + \delta_n) - K \delta_n}{K} \frac{C_n}{\delta_n} &\geq 0 \\ \Rightarrow \lambda_n \lambda_m (1 - \delta_n - \delta_n^2) X^E + \lambda_n (1 - \delta_n^2 \lambda_m) \Delta X^E & \\ \geq (1 - \lambda_m \delta_n (\delta_n + \gamma_n \lambda_n)) \frac{C_n}{\delta_n} & \end{aligned}$$

Russian equilibrium conditions are found equivalently

## A.3 Comparing Expressions 2.2 and 2.3

$$\frac{\lambda_n \lambda_m (1 - \delta_n - \delta_n^2) X^E + \lambda_n (1 - \delta_n^2) \Delta X^E}{(1 - \lambda_m \delta_n (\delta_n + \gamma_n \lambda_n))} \geq \frac{C_n}{\delta_n} \geq \lambda_n \Delta X^E$$

$$\lambda_n \lambda_m (1 - \delta_n - \delta_n^2) X^E + \lambda_n (1 - \delta_n^2) \Delta X^E \geq \lambda_n \Delta X^E (1 - \lambda_m \delta_n (\delta_n + \gamma_n \lambda_n))$$

$$\lambda_m (1 - \delta_n - \delta_n^2) X^E \geq -\lambda_m \delta_n \Delta X^E \lambda_n \gamma_n$$

$$\Rightarrow \Delta X^E \geq \frac{\delta_n^2 + \delta_n - 1}{\delta_n \lambda_n \gamma_n} X^E$$

$$\delta_n^2 + \delta_n - 1 \geq 0? \rightarrow \frac{-1 \pm \sqrt{1 - 4 \times -1}}{2} \approx \frac{-1 \pm 2, 236}{2}$$

$$\delta_n^2 + \delta_n - 1 \geq 0 \Leftrightarrow \delta_n \geq 0,618$$

#### A.4 Renege or Abide?

$$\pi^{Renegade} = X^{IM} + \delta_m \pi^{OR} \text{ where } \pi^{OR} = (\pi_m^{IM} - \frac{\hat{\gamma} C_m}{\delta_m})$$

$$\pi^{Renegade} \geq \pi_m^{IM} \Rightarrow X^{IM} + \delta_m (\pi_m^{IM} - \frac{\hat{\gamma} C_m}{\delta_m}) \geq X^{IM} - X^E + \delta_m \pi_m$$

solving for  $X^{IM}$

$$\begin{aligned} \delta_m (X^{IM} - X^E + \delta_m \pi_m - \frac{\hat{\gamma} C_m}{\delta_m}) &\geq -X^E + \delta_m \pi_m \\ \delta_m X^{IM} + (1 - \delta_m) X^E + \delta_m (\delta_m \pi_m - \pi_m) - \hat{\gamma} C_m &\geq 0 \\ X^{IM} + \frac{1 - \delta_m}{\delta_m} X^E + (\delta_m \pi_m - \pi_m) &\geq \frac{\hat{\gamma} C_m}{\delta_m} \\ \Rightarrow \bar{X}^{IM} &\geq \frac{\hat{\gamma} C_m}{\delta_m} + \left(1 - \frac{1}{\delta_m}\right) X^E + (1 - \delta_m) \pi_m \end{aligned}$$

#### A.5 Payoff Increasing in Stability?

$$\pi_i^{11} \geq \pi_i^{22}?$$

$$\pi_i^{21} > \pi_i^{22} \Rightarrow \pi_i^{11} \geq \pi_i^{12} \Rightarrow$$

$$X_i^{AB} \geq \lambda_i (X_i^{AB} + \Delta X_i^{AB}) + (1 - \lambda_i) X_i^{AB} - \frac{C_i}{\delta_i}$$

$$\Rightarrow C_i \geq \delta_i \lambda_i X_i^{AB}$$

A player will prefer to stay provided the stays if the cost is greater than the expected gain. This was a prerequisite for the Nash Equilibria stated in section 2.3 and it is assumed this inequality holds. Because  $\pi_i^{21} > \pi_i^{22}$ , payoff is increasing in stability.

## Appendix B

## Appendix

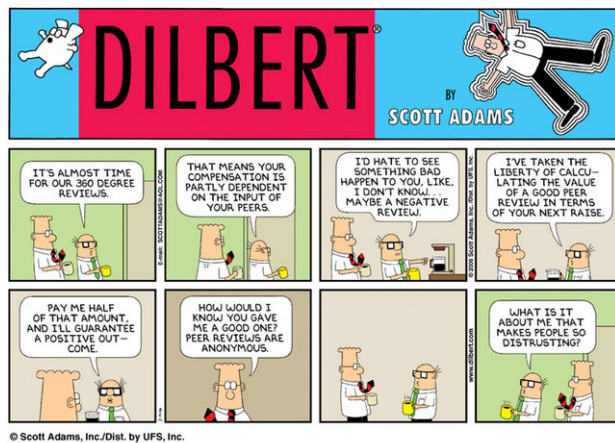


Figure B.1: The Coase Theorem Fails under Asymmetric Information

Table B.1: Regression of stability on all variables

<b>Variable</b>	<b>Coefficient</b>
	(Std. Err.)
relprice	0.428** (0.038)
sqrelprice	-0.197** (0.019)
notrades	0.000 (0.000)
timeinmark	0.023** (0.001)
growthgdp	0.003** (0.001)
pre98	-0.092** (0.010)
post00	0.215** (0.011)
pelagic	-0.075** (0.010)
processed	-0.078** (0.008)
shellfish	-0.041* (0.017)
Intercept	0.136** (0.021)
N	5104
R <sup>2</sup>	0.358
F <sub>(10,5093)</sub>	284.378

Table B.2: Control Regression with  $P_{it}$ ,  $growthgdp_{it}$  and  $NOT_{it}$  aggregated across time

Variable	Coefficient
	(Std. Err.)
mrelprice	0.583**
	(0.052)
sqmrelprice	-0.266**
	(0.027)
mgrowthgdp	0.039**
	(0.001)
mnotrades	-0.001*
	(0.000)
Intercept	0.032
	(0.025)
N	2712
R <sup>2</sup>	0.359
F (4,2707)	379.494

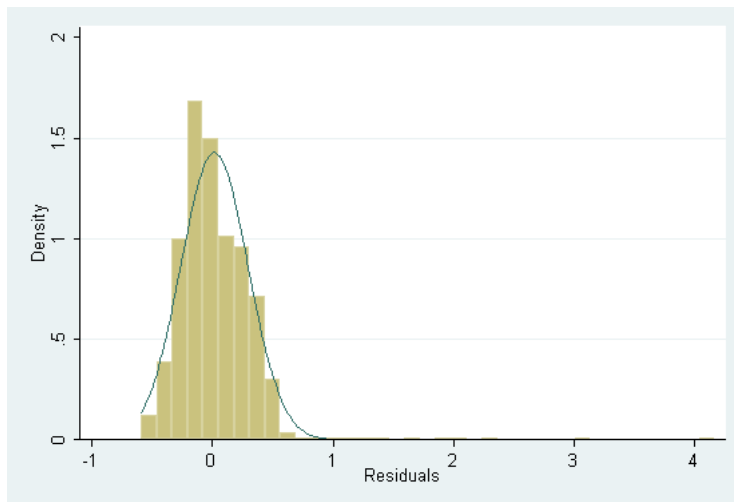


Figure B.2: Histogram of Residuals from Regression in Table B.1, STATA 9.0

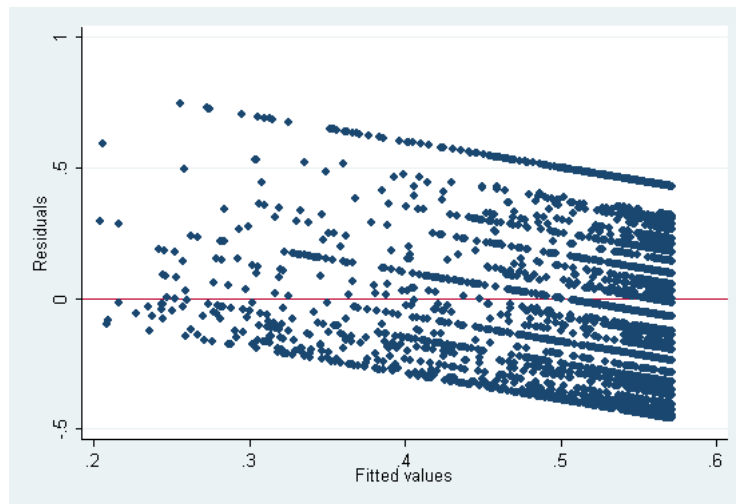


Figure B.3: Residuals versus Fitted Values from Regression in Table B.1, 9.0